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ABSTRACT

This book examines the basic principles of the cognitive psychology of literacy and explains how insights gained from that theory can inform and improve reading, spelling, and writing instruction aimed at adults. The following are among the topics discussed in the book's eight chapters: the principles of cognitive psychology (the nervous system, humans' "two brains," the neuroanatomy of language management, the process of understanding speech and text, speaking and writing); the debate over phonics versus "real books"; the process of reading; the English spelling system; literacy and andragogy; the process of learning to read (paired reading, read-along, "flash" techniques); learning to spell (the utility of spelling rules); and writing. Presented next are chapter notes that include technical information about topics mentioned in chapters 1-8. Among the topics covered in the notes are the following: dyslexia, evidence for visual reading, spelling reform, signal detection theory, and assessment of texts' readability. Appended are the following: discussion of the probable pathways of language management; two stories written by adult literacy students; information about language experience and visual-motor learning; and an example illustrating the ubiquity of "key words." A glossary is also included. The book contains 76 references. (MN)

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TEACHING LITERACY

From Theory to Practice

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TEACHING LITERACY

From Theory to Practice

HUGO KERR

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TEACHING LITERACY:

FROM THEORY TO PRACTICE

To Ken, who stuck around
while I learned something.

About the Author

Hugo Kerr was born in Trinidad, in the West Indies, in 1945. He gained a B. Vet. Med. in 1969, followed by a City and Guilds Certificate in Further Education in 1982 and B.A. in Education and Psychology from the Open University in 1992.

Over the years he has travelled widely and worked in a variety of fields: as a Vet in practice; as a volunteer Vet working with the United Nations in Yemen; as a teacher of English, Biology, Chemistry, and Physics in Tanzania; and as a teacher of English as a foreign language in Denmark.

Since 1980 he has become increasingly involved in the teaching of literacy, a subject in which he has built up wide experience and developed a keep interest.

He is married to a Danish wife and has a son and daughter, who are both at university.

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Introduction

Why has this book been written?

"Classroom practice should always have a firm and respectable Intellectual basis."
(Waterland 1958, p.10)

This book can be thought of as a longish love letter to all of you involved in the marvellous, absorbing endeavour which is "Literacy", at whichever end of the process. The book arises from my own ignorance (rather slowly becoming less absolute) about why? Why do we use the methods we do? Whose idea are they anyway? Why do some feel good and others not? Why are there such numbers of them? Why are they so various? Why do some succeed while others fail? Why do some succeed with this student but not that one? Why does some material stick while other stuff disappears from memory almost entirely and almost at once? Why is one method interesting but another method eye-glazingly dull? Is there anything other than "intuition" behind any of it?

I found, quite early on, that my profound ignorance of any of the theory behind literacy was a very concrete handicap indeed. If I hadn't a clue, say, how spelling was actually done, how could I tell what was or wasn't good method? How was I ever going to develop? How would I ever progress beyond the stultifying, sometimes bizarre and often unsuccessful little collection of hints and procedures I was given at the start of it all? When such and such a procedure failed, why was that? Why did another work so well? Why did students remember so little? Why was progress so slow? Why did students perform so much less well outside the "classroom"?

The book begins by looking deplorably dry and theoretical as it deals with the basic cognitive psychology of literacy. The first chapters are, however, absolutely central to the book, the purpose of which is precisely to demonstrate theory and how it meets and informs practice in literacy work. There is a certain amount of jargon in there, but as little as necessary, I promise. I appreciate that the very word "psychology" (especially with "cognitive" in front of it) is enough to cause some readers suddenly to decide to make a pizza, or a start on painting the bathroom, but...

My immediate plea is: be ye not afraid of a little cognitive psychology! Cognitive psychology is simply the enthralling study of how your amazing mind does all the things it does, like reading, talking, making a pizza, painting the bathroom etc. etc. The word "cognitive" means to do with knowledge and performance as distinct from emotions, feelings and so on. Cognitive psychology is, therefore, not to be confused with psychiatry, the study of personality and social interaction, of personal behaviours and feelings. Cognitive psychologists are interested in the mechanics, really, of subjects like memory, perception, vision, problem solving, language management and so on. Right here we are interested in how your eyes see and your mind reads, how you reach meaning from text, how you take meaning and turn it into writing, how you decide on a spelling (and, having done so, deside weather it is write or knot).

A grounding in, a basic understanding of, the cognitive psychology which underlies the skills of literacy is profoundly enabling; it empowers and frees. It frees from blind dependency on all those pre-digested methods prescribed elsewhere, by someone else, for no one in particular. The happy teacher who understands something of cognitive psychology is able to see more clearly what is really likely to be going on, why and how; is able to move on with the confidence of firm ground under the feet, is able to adapt, evolve and grow.

At this point it may be useful to consider the layout of the book and how it may best be used. The first half or so is pretty well pure theory. It may strike you as rather remote, but it is erecting the all-important framework of language management which we need to understand if we want to inform our practice.

First, we need to have a basic grasp of the architecture of the brain — how the "wiring" is probably laid out and arranged. From this we can go on to appreciate how the brain's basic procedures may be carried out — procedures with resounding names like Spreading Activation, Top-Down and Bottom-Up Processing, Cascading Analysis. Maybe you should be warned in advance that this is the heavy bit. It will all be over by the end of the second chapter, though, and then we can begin to have some fun, to play with theory. We will be able to consider how we see and read, to develop a probable map of mental pathways by which reading is achieved and to peer into the great "Phonics vs. Real Books" debate. We may apply, then, the same model-building to spelling and writing and, finally, conclude our look

at theory with a brief examination of the English Language itself from the point of view of someone wishing to teach literacy in it.

Having done our duty by the theory we start to apply it to practice in the last half of the book. This is intended to illuminate our teaching with those insights which can only be gained from theoretical knowledge. We look at the teaching of adults per se, and at the teaching of the three main skills of literacy: reading, spelling and writing. You will notice that much of the book is taken up with notes to various chapters. This device is intended to remove some of the driest bits from the main text to chapter notes so that you may read on at a lighter level or plunge into the theoretical depths to suit time and taste. There is a glossary of terms used in the book, though I also explain them as I go along.

I can only hope you will find reading the book as much fun, and as technically rewarding, as I have found writing it to be!

Chapter One

Introduction to cognitive psychology *(What is it?)*

When I was first introduced to the world of adult literacy teaching, the following quote, I am afraid, applied. Literacy tuition provision was:-

> *"a practically random pairing of complete strangers, frequently from very different social backgrounds, brought together to conduct an intimate and technically difficult transfer of skills often on the basis of little more than shared optimism."*
> (Levine 1986, p.950)

The little batch of new volunteer tutors, of which I was one, was given training — twelve hours of practical tips and exhortation with a lot of cryptic handouts. We were then considered ready for student allocation and off we went, working, in those days, in disconcerting seclusion, one to one, often in the student or tutor's home. It was generally accepted that literacy was, in fact, almost insuperable, a Byzantine labyrinth of incompletely understood skills and sub-skills which could only be learned through endless performance of eccentric and often rather infantile exercises — labour intensive for the tutor and repetitive for the student. It was, therefore, sold to us partly as a sort of general social support endeavour, not as a technical project with technical skills and parameters. We all struggled on (and on and on), often for years, with the same student in much the same state, slowly toppling into the long grass by the wayside. We tutors, lacking a "firm and respectable intellectual basis", were suckers for all those bizarre schemes and sub-schemes endlessly exploring such oddities as vowel digraphs and consonant blends, endlessly seeking, as with the never-ending Christmas turkey, new ways to present the same thing. A singularly torpid pace, curiously forgettable material, and an almost perverse inability to use anything apparently learned in "class" anywhere else at all became accepted as standard, inevitable, and thus tolerable. Except, of course, that they are not!

We all need solid intellectual ground beneath the feet. This book discusses the theory underpinning literacy and the teaching thereof. Such theory is exciting, beautiful, eye-opening, and, in the end,

liberating. Anyone likely to read this book is interested in the teaching of literacy — perhaps, like me, a literacy tutor convinced it can be better done and fascinated as to why it sometimes is and sometimes isn't. As one tutor despairingly cried: *"Why does she spell 'people' correctly?"* (Charnley & Jones 1981)

The home of literacy is in the mind. To understand literacy, therefore, we have to try to understand how the literate mind reads and writes. The study of literacy falls within the general discipline of cognitive psychology, the study of how a mind does all the routine, mundane things we take so completely for granted — the study of how normal minds do normal things. Cognitive psychology is a fascinating pursuit of deeply secret procedures. It may well be the real "last frontier". The mind is very swift and very efficient but its methods — its procedures and processes — are held secret from us. They are carried out in what we generally call the "subconscious", for want of a better word. (In moments of exasperation "the murky depths of" is put in front of "the subconscious"!) We know, usually, more or less what information has gone in, and we get a decision, as output, almost at once, but we have only an outline idea how B was reached from A, what processes and procedures were gone through.

And the things that our minds can do are spectacular! Consider Wimbledon. A player, based on learned information about ball behaviour, partial evidence from his own last strike (spin, speed, trajectory, and direction) and his opponent's return strike (stance, racket angle, trajectory, and speed, as well as early evidence of the ball's trajectory and speed) must decide what to do. He computes ball speed, trajectory, spin, and position (in three dimensions) at a future time (less than half a second away). He uses this to compute his own movements (arresting previous movement, balancing, setting up a co-ordinated network of new movements to include separate body) and racket movements, the latter to include detail of planning formulated in the last few milliseconds relating to desirable ball movement (spin, trajectory, speed, and direction) to include analysis of opponent's movements since his strike — and finally recovery from this new movement to achieve balance again.

Our hero executes all this co-ordinated activity and successfully (he is going to be champion, I feel) strikes the ball. While all this has been going on, though, he may also have been considering longer-term strategy: is his opponent getting nervous? Is he poorer at

net or baseline? He may even have time to wish that the shrieking lady fan in the front row close to the service line would go away and *stay away*. And our hero has no idea whatsoever how any of this is done — what mechanics, what wiring structures, what arrangement of brain cells and connections, processes and procedures could possibly actually do all these things, so rapidly, efficiently and well, and all without, apparently, involving "him" at any stage.

Literacy, at least as I practise it, certainly seems less spectacular, but the reading, writing and spelling we perform with such speed and accuracy is not much less remarkable! In the following chapters we study these with the literacy teacher's viewpoint at the front of the mind, but first we shall have to consider the amazing brain (or should that be brains?) in our head.

The Nervous System

The basic layout of our nervous system is well known. Just about every part of our body is supplied with nerves. These either gather information for, or deliver instructions from, the brain up at the top of the system. Nerve cells are what make up the system. These cells have bodies which can have either extremely numerous or very long protrusions. Nerve fibres, which carry nervous impulses, are such very long cell protrusions. Cells in the brain make thousands of electrical connections with other brain cells, close by or far away. Since there are some eight billion cells in the cerebral cortex alone, you can see that some very elaborate, even rococo, circuitry can be built. Not only are connections between cells numerous, but they can also be excitatory or inhibitory. An excitatory connection makes it easier for a stimulus to pass, an inhibitory connection makes it less likely. In other words, the system can make "on", "off" and "dimmer" switch connections. The vast number of interconnections arising from or impinging upon every brain cell, and the fact that some of these connections are "on" and some "off" switches, are the two most salient facts about the wiring of the mind for our purposes.

We can think of the brain as in two major functional parts: the brainstem and the forebrain. The brainstem need not, as they say, detain us long. It is a very complex interconnecting and switching system which sorts incoming information and outgoing instructions, monitors the body's major systems, and co-ordinates most unconscious or automatic activity. It keeps us alive and controlled,

and acts as an information sorting system, but it doesn't do any "thinking" or have any fun.

We are more interested in the forebrain, and the part of the forebrain in which we are interested is the cerebral cortex — Hercule Poirot's "little grey cells". Here is the thinking equipment, the seat of the conscious, aware "self". Here is the management of higher-level information, the sorting, combining and recombining of ideas. This is where we really live, where all those debates as to who and/or why we are, whether God really exists, what consciousness really is, whether Liverpool will ever win the FA cup again, and where I last used the soldering iron, actually go on. It is also where activities such as literacy take place, partly in the conscious mind and partly (the skills having been so thoroughly over-learned) subconsciously. This unbelievable cerebral cortex is a two-square-metre sheet of nerve cells, about half a centimetre thick, folded up all over the surface of the brain. It is what you see when you look at a brain, therefore, as in Figure 1.1:

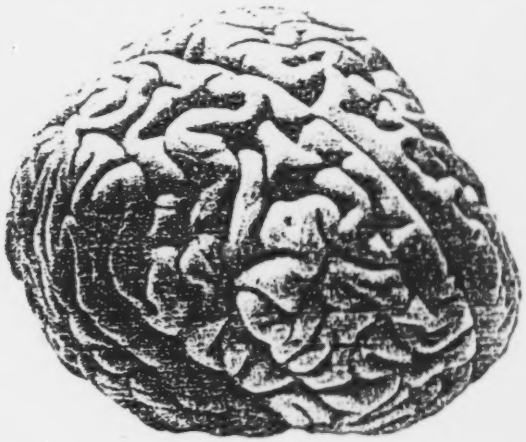


Figure 1.1 The human brain

Our Two Brains

You can see that the cerebral cortex is split — it is in two halves, the left brain and the right brain. The disconcerting fact is that every one of us has, not one, but *two* brains. Even more disconcerting is the fact that these two brains are not just two halves of one thing, or two replicas, mirror-images, of each other. Our two brains are quite separate and completely different individuals! Your left brain and your right brain have completely different patterns of skills and see "reality" from very different viewpoints. However, they are connected by a wide band of millions of nerve fibres known as the corpus callosum. Your two brains communicate so swiftly and so completely via this corpus callosum that you have been deluded into imagining them to be a single unit, one brain. Each brain is kept so instantly and fully informed as to what is going on in the other that we cannot tell them apart under normal conditions. However, very severe epileptic patients were, at one time in the USA, treated by the surgical severing of the corpus callosum, thereby isolating the two brains from each other. The effect on the severity of their epilepsy was only sometimes an improvement, but these "split-brain" patients were soon realised to be very special subjects, in which one brain at a time might be accessed if the method used were cunning enough. Work with these patients has provided much of what we now know about our different minds. (See also Springer and Deutsch, and the notes to this chapter.)

Your left brain (almost invariably) is the logical, linear thinking one. A bit dry perhaps! It is in your left brain that most language management takes place. Your right brain is a poor reader and speaker, particularly poor, for example, at reading aloud. Your left brain is much better at handling the sounds of language. Your right brain (almost always) is the more holistic mind, perhaps more creative and a more "lateral" thinker. Your right brain is more "into" the relationships between things than your left. Your right brain is probably better at handling and, in fact, appreciating sounds other than language — music, for example. Together your two brains make a fabulous team!

It is as if you have two people resident inside your skull. You can think of them as "Lee" and "Roy". Lee is the scientific thinker and talker (but maybe a bit boring?); Roy is the quiet, artistic, interestingly "different" one. These two communicate so constantly and totally that they fool you into seeing them as one person —

"Leroy", perhaps, a single personality. Maybe Lee is a "Yuppie" and Roy a "Hippie", but Leroy a balanced, whole personality?

The only reason for discussing our two brains in this book at all is that it was once widely thought that literacy acquisition was related to brain and hand dominance. People talked a lot about "crossed laterality", or "cerebral dominance", and they still sometimes do. It was frequently handed out as an explanation for "dyslexia". The fact is that one "hemisphere" (one of your brains), usually the left, normally dominates the other, and one hand, usually the right, normally dominates the other (most of us are right handed). If the brain and hand of the same side were dominant, it was once thought that you would be at greater risk of difficulty with literacy (and other detailed cognitive activities). Left handers, for example, who were known generally to have a left-brain dominance just the same as right handers, and were assumed to be managing language in that left brain like almost everyone else, were therefore writing with the hand which was actually under the control of the other, the right, brain. *None of this is any longer thought to have the slightest effect on literacy performance!* I offer it merely as an item of historical interest which you may still find in odd corners of the literature.

Microstructure and Wiring *(How's it all done?)*

If you examine the cerebral cortex under the microscope you find it is a layer about a hundred and ten cells thick, on average. You find also that the cells tend to be arranged in columns. Each column is thus an arrangement of about a hundred and ten cells in a line, and it is believed that it functions as the unit which analyses a single detail of information. Each column of cells "thinks about", processes the information about, one highly specific detail. These columns of cells seem themselves to be arranged into modules, each module responsible for analysing related information, for thinking about one subject, perhaps. We can use voice recognition as an example. We recognise people by their voice alone, so must have a "voice bank" in there somewhere. Perhaps each column in the voice bank is responsible for monitoring incoming voices over a narrow range of frequencies. A module of several such columns will, then, be able to "read out" the frequency distribution patterns of any voice heard.

Remember, though, that every cell, in every column, makes thousands of connections with, and receives thousands of connections

from, other cells in other columns, some nearby, some far away. Some will connect with closely related columns in modules dealing with closely related information, others will connect with distantly related columns in modules dealing with distantly related information. Remember also that some are excitatory "on switch" connections whilst others are inhibitory "off switch" connections.

Supposing I know that my wife and my son are both in the house, and a voice calls out my name. My voice recognition modules burst into action. They detect some high frequencies. These will tend to excite the distantly related modules of "wife identification" but will also tend actually to inhibit those for "son recognition". I will be a little way towards the correct identification of my wife's voice before even I have fully completed the analysis of the frequencies in it! The excitation of "wife recognition" modules will tend to excite distantly related modules, for example those to do with shopping — we are to do the weekly shopping this evening and these modules will tend to excite those in which (I hope) the information as to what we need to get from the supermarket is stored. All this activity (it is time to go) will tend to inhibit activity in those modules presently engaged in locating and organising ideas about psychology and dressing them in respectable language.

This has been our first glimpse of the process of "spreading activation" whereby any incoming stuff tends to reverberate around all sorts of perhaps only vaguely related subject areas in the brain. You can begin to see how this kind of process, especially if on/off switching is built into the system, enables decisions to be reached as to what we have perceived, for example, and what we should do about it. Spreading activation not only enables decision-making but also enriches information by involving all sorts of different facets of it. We "think of" all sorts of different aspects of everything that comes along, inevitably. This combining and re-combining of information within the mind is called "association". It is held that fully ninety-five percent of activity in the cerebral cortex is pure association within it, only five percent being simple receipt of input or delivery of output. This association can be thought of as what would, today, be called "information processing". (Though see a fascinating article by Frank Smith in Olson et al (1985) debating whether what we have in our heads should properly be considered "information" at all!)

The Neuro-anatomy of language management ***(Where's it all done?)***

We will be discussing the management of language (its paths and its structure and the implications thereof for literacy teaching practice) later in the book. Right now, though, we should look briefly at "neuro-anatomy", at where in the brain the particular activities relevant to literacy actually happen.

The function of the cerebral cortex is (to say the least) imperfectly understood as yet. Certain areas are, all the same, known to carry out certain very specific functions. It is known that most people manage language pretty well exclusively in the left brain. The actual, known layout of language management is shown in Figure 1.2.

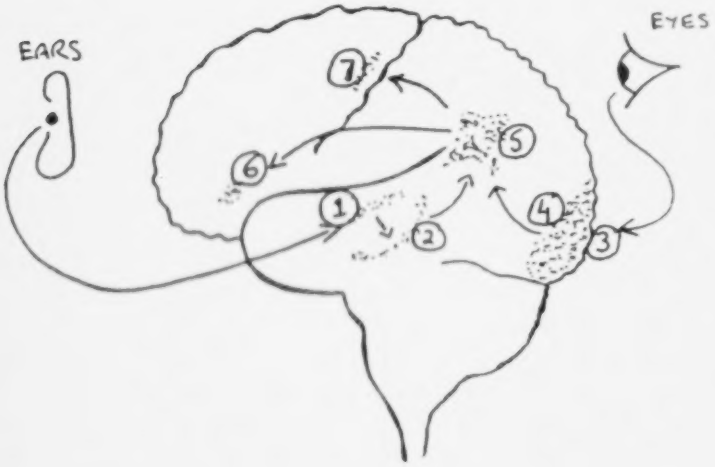


Figure 1.2 Language management: left brain

Understanding speech: from sound to meaning

Using the map of language management centres and pathways in Figure 1.2, let us now consider how we might translate the rather indistinct noises emanating from your companion into meaning inside your head. Let me here introduce the notion of "lexicons" in the mind. "Mental lexicons" will reappear in Chapter Two, when we consider routes to reading, and again in Chapter Four, when we look into routes to spelling. Perhaps you will find a sneak preview helpful, in which case the entire structure is in Appendix 1 at the end of the book.

We deal with language in several completely different manifestations. We hear it as sound, see it as symbols, and keep it in our minds as abstract meanings. We also deal with the stuff as instructions to the muscles of speech and of the hands. It follows that we must have sites in the brain where these different incarnations of language are stored and can be accessed for recognition purposes. These are the mental lexicons. We must have a "semantic lexicon", for filing language-as-meaning, at least one "auditory lexicon", for filing language-as-sounds, and at least one "visual lexicon", for filing language-as-visual symbols.

Right now we shall deal with basic language management in terms of its actual anatomical siting in the left hemisphere. Later chapters will discuss the practical significance of this very dry theory.

Beginning, then, with speech, with language-as-sounds reaching area 1 in Figure 1.2, from the ears. This area is the "auditory association area", also called "Wernicke's area" (after he who discovered its function in the late nineteenth century). Here the incoming noises are analysed until recognised as the constituent sounds of speech ("phonemes"). This raw material is then passed to area 2 in Figure 1.2, the "speech association area". Here it is assembled into mental representations of language-as-sound. It must be represented by sound, in what we can call "phonemic code", at this point. It is, perforce, in a mental lexicon where language is held in phonemic code and this area can therefore be called the "auditory input lexicon".

The stuff has been heard and recognised as speech, but is not yet "understood". This phonemically coded set of linguistic bits and pieces must be sent further, to area 5 in our map in Figure 1.2, to the "language association area". This is where language-as-meaning is

stored — it is the site of the "semantic lexicon". Our phonemically coded linguistic units can access and activate their corresponding, semantically coded counterparts representing language-as-meaning in this lexicon. At this point, when the correct semantic units have been activated, we can claim that spoken language has been understood; we have reached meaning from noise.

(A wee diversion: you may already be becoming a serious cognitive psychologist and demanding to know how such distorted, weak, and variable signals (as speech and handwriting undeniably are) can yet be so easily and accurately understood. One very plausible paradigm is the "pattern associator". This is a small network of connections enabling one mental representation to be translated into another even in the absence of full and perfect information. See also Notes to Chapter Seven, and McClelland and Rumelhart 1986, pp. 33-37.)

Understanding text: from symbol to meaning

The neuro-anatomy (for such it is) of reading to meaning is, in principle, much the same. Language is presented as text — as a collection of visual symbols or "graphemes". The eyes pass the information to the very back of the brain, to area 3 in our map in Figure 1.2, the "visual association area". Here it is analysed into mental representations of language seen (letters or letter patterns or features of individual letters, we don't yet know). This material is passed to the "symbol association area" which is in area 4 on our map. This is where symbols seen are recognised as units of language-as-symbol, where language is, perforce, represented in "graphemic code". It is, necessarily, graphemically coded language being held in a mental lexicon we can justifiably call a "visual input lexicon".

However, we still have no meaning for the language. We must pass the material further, to the language association area or "semantic lexicon". Each graphemically coded item can access and activate its semantically coded equivalent in the semantic lexicon. Language-as-symbol activates language-as-meaning and, at this point, we can say that text has been "understood". We have read to meaning, we have deciphered the meaning of the squiggles on the page.

Speaking and writing: from meaning to sound or text

What about producing language then, either as sound or symbol? To do this we have first to activate meanings in our semantic lexicon, to activate mental representations of meaning. (Actually a puzzle in its own right, for "who" activates the meaning, on what instructions, and how?) Anyway, not to get too bogged down, let us go from the point at which someone has activated appropriate entries in the semantic lexicon. We can use these to access and activate either representations in the motor system which will produce the muscle movements necessary to make speech sounds, or those to produce the hand movements of writing (or typing, or semaphore, or Morse code, or sign language, or whatever!).

Producing speech, then: we activate units for language-as-meaning in the semantic lexicon. We pass this material to Broca's area (in area 6 on the map). In Broca's area, semantically coded language is translated into motor coded language, into language-as-instructions-to-muscles-of-speech. Meaning is translated into those muscle movements which will produce it in sounds. We speak our meaning.

Producing writing: we pass our semantically coded language units from the semantic lexicon to the hand motor area (in area 7 on our map). Here, semantically coded language units can activate language-as-instructions-to-muscles-of-the-hand. Meaning is translated into the hand movements necessary to write (type, wave, press, or signal) it in symbols. We write (type, wave, press, or signal) our meaning.

To summarise thus far:

We have seen that we have not one but two brains up there. We have described the cerebral cortex and the basic neuro-anatomy of language management therein, in mental lexicons which must correspond to the various manifestations of language itself. We have discussed how the wiring system is probably structured and how it probably works. We noted that specific cognitive activities tend to be performed in specific areas of the cortex and that these can be mapped. We have suggested that analysis of information goes on in columns of cells arranged into modules by function. We have noticed that a truly enormous amount of interconnection between modules is built into the system. We have seen that such connections can be weakly or strongly excitatory or inhibitory. We are, therefore, in a position where we can examine two very basic psychological

concepts, "spreading activation" and "cascading analysis" with top-down and bottom-up processing.

Spreading Activation

To begin with *spreading activation:* this is a simple and subjectively obvious feature of the wiring up of the "little grey cells". Drop almost any idea in, say "Christmas", for example, and a whole collection of related ideas becomes activated. Not all will be so strongly activated as to reach your consciousness and "awareness", but all ideas even remotely connected with (wired to) the original will have reacted to it. You may well find yourself deliberately using this feature of your mind when trying to remember something specific. Often the best way is to think of something you know is related — maybe something that happened at about the same time, maybe something about the location it happened in, maybe who was there at the time, maybe another bit of the same subject, and so on. One thing, as they say, often leads to another. What you wanted will be, as you knew it would be, activated by the activation of a related thing, and thereby rendered more accessible to your conscious mind. (Learning, in fact, is presumed to be a matter of wiring patterns, of connecting cells in patterns which join and relate ideas in particular ways.)

Spreading activation is, incidentally, not usually a thing we can choose to do or not to do — it just happens. Activating one cell automatically sends stimulation away off down its myriad processes to all the cells to which it is connected. Spreading activation is, in psycho-jargon, "mandatory".

Top-down and bottom-up processing

Bottom-up processing theory is the somewhat simplistic idea that your mind makes decisions as to what is going on around it based simply and unquestioningly on incoming information. Your mind, here, is seen as a blank and incurious organ passively collecting and dispassionately examining every one of all the zillions of bits of information presented to it. The decision as to what should be said to have been experienced awaits careful evaluation of all this evidence. Decision-making is seen as a purely reactive process. There is no questioning or presupposing. All decisions are coldly based on evidence presented. There is no prejudice or preconception and no

effect of previous context; no judgement or possible inference will be given any more weight than any other. Nothing will, presumably, ever occasion surprise, since everything is as likely as everything else!

Top-down processing theory envisages a far more proactive mind. Your mind is seen as actively forming hypotheses all the time as to what might be, what probably is, going on. These hypotheses are, of course, founded on past experience — recent or remote. With such hypotheses in hand your mind sets off out into the world searching specifically for evidence. Your mind looks particularly for relevant evidence. It discards or ignores a great deal of the incalculable amounts of material continually being presented to it. (If it had no hypotheses, how could it decide whether a bit of information is relevant or not? Information can only be relevant to something!)

Your mind, then, probably continually generates hypotheses as to what goes on and so need only search for that minimum of data which will enable it to confirm or refute these hypotheses. Your mind suggests to itself (on the basis of experience, of information already held in it) what may be happening. Your mind, then, only has to "interrogate" the evidence until it can conclude whether the original suggestion is probably right or probably wrong.

Using the paradigm of top-down processing we can see how your mind is able to make much quicker decisions based on much less, or much less perfect, information than if it had to rely on pure bottom-up processing. For example: my son, upstairs in his room, two doors between us, is playing the "Sergeant Pepper" album — an album I know backwards. I can only just hear it from here, and muffled at that. I believe I can hear the words quite clearly. This is, of course, nonsense. I already know the words and so I need only the slightest, most imperfect, bit of relevant musical information before "hearing" them apparently perfectly clearly. If it were another album, a Bob Marley album, say, I would not be able to make any words out at all!

An over-simplification as an example:

When we first arrive at Fred's and Hermione's New Year's Eve party, bottom-up processing theory has it that our minds are completely taken up with deciphering the immediate and are free from any pre-conceived ideas as to what might be taking place behind their front door. When we are let into the house, we look about us, assembling information, finally concluding that there are a lot of folk dressed up to the festive nines, clutching drinks and behaving with

extreme brightness. "Aha!" we say. "Probably a party!" (Had the room been full of sheep we should presumably not have been astonished since we had no pre-formed views.)

Top-down processing theory, on the other hand, claims that as we came through the front door we expected to see people roaring at each other above many decibels of Rock music. We gather just enough evidence to confirm this (which, given the size and number of Fred's and Hermione's loudspeakers, doesn't take long, after all) and can immediately begin searching for more specific detail — for example, for either Fred or Hermione. (We have to give our bottle of plonk to someone.)

Of course, the truth lies, boringly enough, somewhere in between. We probably use a mix of top-down and bottom-up processing. Some situations are highly predictable and a skeleton minimum of data will be enough to enable quite satisfactory processing (Sergeant Pepper, for example, or driving to work), using old information already in the head. Other, less well-known situations demand that more careful attention be paid to incoming data, to new information. For it really is a matter of a mix of old and new material. Reading a romance, for example, demands very little attention. There will be relatively few new details. It's all been seen before. It can be read very fast and pretty well completely in "automatic pilot" mode. Contrast reading a textbook on, say, the calculation of stresses on bridges resulting from wind forces. This is unfamiliar territory and will need more bottom-up consideration of data. Skimming over sentences will only result in failure here. We need to pin down every item of fact, every turn of argument, to understand. We have very little old information in our heads. We cannot use what we already know to guide us along, as we know next to nothing!

Cascading analysis

If we do use a mix of top-down and bottom-up processing, and if we incorporate the excitatory and inhibitory connections we know to exist, in the colossal quantities we know them to exist in, we have the wiring requirements for a cascading, feature analysis reading model as proposed by Rumelhart and McClelland. They have not only proposed this model but have built it into a computer simulation. The thing "reads" a vocabulary of some twelve hundred words of four letters or less, presented in a simple and consistent script. Within these rather

limited parameters the machine reads accurately and swiftly. By altering the text the programme can be induced to make "guesses" and errors. These are found to be remarkably similar to the errors and assumptions that people make under similar circumstances. Its "reading behaviour" is said to resemble ours. The model seems to be robust and plausible. It has stood the test of time and the attentions of other investigators well. None of this is proof that we really do read in this manner, of course, but the model is felt, nonetheless, to represent more or less what real life reading is very possibly like.

Figure 1.3 is a simplified diagram of their model, where "+" denotes an excitatory (on switch) connection, and "-" denotes an inhibitory (off switch) connection. (Rumelhart & McClelland 1982, as cited in Ellis 1984 and many other texts.)

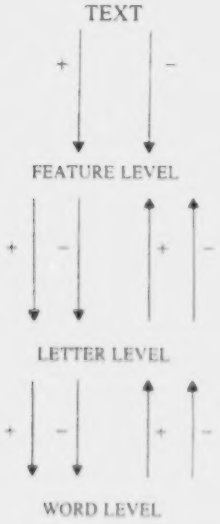


Figure 1.3 Rumelhart & McClelland's model of word recognition by cascading feature analysis

The model is, in fact, complicatedly simple, as are so many biological processes. By this, I mean that the procedure is simple in

that the constituent procedures of which it is made up are simple, but that the procedure is complicated in that a stupendous number of these mini-procedures operate simultaneously. Each little procedure is simple and, in itself, achieves only a tiny fraction of the whole. Correlate a lot of these, though, and you have swift achievement of very complex ends. (The breathtaking thing about biological processes is not so much the processes themselves but their vast number, boggling interconnectedness and intricate, accurate and immediate correlation and control.) As far as cognitive psychology is concerned, this complex co-ordination of a multitude of mini-achievements is a result "simply" of the wiring, the distribution of connections between little grey cells, a function of the shape of the circuitry. (Learning is presumed to be the laying down of this pattern of connections rather than that.)

So how does the model work?

The model, please note, is entirely mute. It reads purely visually. It postulates that letters are recognised by *feature analysis*. Letters are visually analysed into certain features — a curve here, a line here, a bit below the line here, and so on. A feature, once recognised, will tend to excite the mental representation of all letters which contain it and inhibit all those which don't (the + and - connections on the diagram). Letters can thus be rapidly and efficiently recognised. Suppose, for example, a feature recognised was a downstroke "⊠". The mental representations of all letters with this feature (B D E F H I J K L M N P R T b d f h k l t) would begin to be activated. Other letters would begin to be inhibited. Suppose, however, that a curve "⌒" is also recognised? All representations of letters containing this *and* the downward stroke will be activated, and others inhibited. With only these two features we have already got to a probable B, b or h! If we envisage a battery of recognition units for, say, a dozen features of letters we can imagine a pretty fabulous letter recognition system. What's more, if it is the result of connections between cells, the structure of the wiring system laid down, then it is pretty well foolproof and automatic.

It is time to head off on a short deviation, to consider what seems at first sight to be a paradox. It would seem to make sense to postulate a feature analysis recognition system of great specificity, a meticulous, scrupulously accurate system. On the face of it, it would seem likely that we should have a feature analysis system which is

very precise, a recognition system which very precisely identifies features and which then matches them very precisely with other features to achieve very precise recognition. Such a system would really be a thing to be proud of, wouldn't it?

In fact, it would be a disaster. It would be next to useless because, of course, incoming data is almost never anything like precise. Consider, for example, the dog. We can all recognise a dog for what it is — a dog. We can do this, on the basis of a very brief glimpse, very fast, very accurately, very consistently, and very definitely. We do it so easily that it seems unsurprising. But dogs probably come in an infinite variety of shapes, sizes, colours, degrees of hairiness, bounciness, and so on. You can easily recognise a dog, even if you only get a glimpse of a bit of it for a fragment of time. You can recognise a dog from any angle — from in front, from the side, from behind. You can recognise a dog this way up or that way up. A three-legged dog remains a dog. You can even recognise a dog the like of which you have never seen before. (When Chihuahua dogs were novelties no one had any difficulty categorising them as dogs at first sight, rather than, say, cats or gerbils.)

What are we, probably, doing here? We are probably applying a shortlist of feature "questions" (and, as we have just seen, quite a short list will probably do the job). We probably apply the shortlist to incoming data and accept features *even if they are only approximate*. By accepting approximations, but using a feature list which is long enough, we can swiftly, under most circumstances, recognise even completely new varieties of known categories. Maybe, for example, we categorise something as a something if it shows, say, ten out of twelve of the necessary features to a degree of, say, eighty-five percent satisfaction? Very occasionally we might (very occasionally we do!) get it wrong, but it probably won't happen often. This is probably an acceptable risk for the enormous gain in flexibility. (How else, for heaven's sake, would we ever read handwriting?)

If we had to learn, and carry about, exact feature recognition units for every possible feature of everything we had ever seen, from every possible angle, our heads would, presumably, have to be the size of large water melons — and we still wouldn't be able to categorise anything we had not previously seen!

Right then, back to Figure 1.3, the cascading analysis model of reading, fortified with the knowledge of our own wonderful

inexactitudes. You will recall that we had got as far letter recognition by using a shortlist of features. We have, then, a few letters sort of recognised, in a certain order. These letter units will excite word recognition units which contain them and inhibit those which don't. For example, a curve, a line and a curve, in a three-letter format, thus "⌒ \ ⌒" will begin exciting letters like "o" and "e" and "a", with letters like "v" or "x" in between. Even while the search for letter recognition is going along, though, the search for word recognition can also begin. (It could be eve, or ova, or oxo or eye...)

You will have noticed that, up to now, the whole procedure has been bottom-up. The model has simply been reacting to incoming data — the stuff on the page. The model at this point, however, begins to form hypotheses as to what the word might be. The mind begins, using what it already knows, to search incoming data specifically for details which might confirm its ideas. For example, in a section of text about reading it is much more likely that our three-letter enigma will turn out to be "eye" rather than eve, oxo, or ova! Knowledge of the context has enabled us to get closer to the right decision even with very little actual data. (In point of fact, some research indicates that really fast readers reading very easy text may go too quickly for context to be much use, and so read more or less exclusively bottom-up. When not able to read so fast — a more difficult text or a slower reader — the effect of context probably does matter. Slower readers should, in other words, be encouraged to use context and "have a go".)

The procedure here described is *feature analysis in cascade*. It is called this because bottom-up identification one way and top-down search the other are both active at the same time. Data is travelling one way and expectant search the other, simultaneously. The whole chain bursts into a buzz of two-way speculative activity, final decision-making being possible a very short time after first presentation of the text. A decision is also possible in real life, as we have seen, even if the text itself is only partial or distorted (as with my hand-written notes!)

Cascading feature analysis as described here is likely to be something like what we use in reality, except that we probably don't analyse text letter by letter. It sounds outrageous at first but the fact is that we very likely do not need fully to identify the letters making up text when we read it. It is even probable that we actually cannot read

to meaning and identify individual letters both at the same time! Consider Figure 1.4 for a minute.

Figure 1.4

Well, what did you see? This is, of course, the old cliché; either two faces or a vase-like thingumajig. But, please note, you couldn't see both at the same time. You saw *either* the two faces *or* the whatsit — *never* (it is impossible) both at the same time. In other words, you can either see letters or you can see words, *but you can't see them both simultaneously*. It is not possible to perceive the same visual stimulus as two different things at the same time. (Smith 1988 esp. p. 11 & p. 126)

And why, if we are able to seek uniquely identifying features in letters, can we not also seek such features in words? Supposing that in order uniquely to identify letters (which commonly present in so many varieties of form) we have to apply, say twelve tests. (Does it, we ask, have such a curve in such a position? And such a line just there?) Why should we not be as well able to apply as many, and general, visual tests to whole words, thus recognising them directly? Look at Figure 1.5.

The headmaster at my last school had a heart of stone.

You can get replacement parts in any good D.I.Y. store.

Melissa spent the whole day staring
over a hot stove.

Figure 1.5

Did you manage to read those sentences? Of course you did. Did you notice that the last word in each was visually identical but 'read' differently? To have managed that reading you must have been ignoring letters *per se* and reading words whole.

He will be meeting her at the
station at 4 p.m. tomorrow.

Figure 1.6

Letters often disappear altogether. You read Figure 1.6 easily enough, yet the "ing" in meeting, and the "ion" in station have become mere squiggles.

Now try Figure 1.7 which uses "an alphabet designed as part of an experiment to determine how much of each letter of the lower case alphabet could be eliminated without seriously affecting legibility". I believe that you will find this easy enough to read. If this whole book were written in this depleted text you would find it as easy, by the time you were this far into it, as standard print.

an alphabet designed as part of an experiment
to determine how much of each letter of the
lower case alphabet could be eliminated without
seriously affecting legibility

Figure 1.7 A minimal feature alphabet
(from Spencer 1969, as cited
in Beard 1987 p. 45)

Summary

We have bitten the bullet! Since literacy undeniably takes place in the cerebral cortex, we have bravely investigated that organ in some detail. Much cognitive psychology was there, in fact.

We have seen that the cerebral cortex is made of billions of "little grey cells" arranged in columns which are, themselves, arranged into modules according to their actual function. We have seen some of the neuro-anatomy of language management as performed in the left hemisphere, and have been introduced to the idea of mental lexicons where language is stored in different "codes" — phonemic, graphemic, semantic, and, probably, various "motor" codes.

We proposed that the mind may work in simultaneous top-down and bottom-up cascading analysis. Since communication between cortical cells in the cortex is copious and inevitable, given the immense amount of interconnection, it follows that spreading activation is a pronounced feature of brain activity. Processing is "parallel" and "distributed" -- it happens all over the place at the same time. Different aspects of whatever is going on are analysed at the same moment in different parts of the cortex. This gives us colossal computing clout.

Cascading analysis, using feature analysis, allows our proactive minds to reach decisions very fast with little information, even incomplete or degraded information. We very easily, swiftly, and accurately identify stimuli, probably by the application of a small selection of features which we accept even if they only approximate. We probably read by top-down and bottom-up cascading analysis of features and probabilities. The unit of text we actually identify is, though, probably a whole word rather than individual letters.

Chapter Two

The Great Debate: Phonics vs 'Real Books'

Every now and then, literacy, at least in schools, makes the headlines. For a while, heated arguments rage. The media go into overdrive. The tabloids find shock-horror schools to run flamboyant stories about. Politics rears its horrible head. The science and art of teaching is widely held up to ridicule as a blind mix of subversion and ignorance. Everyone in the bar of the "Dog & Bottle" airs their expert opinion; after all, everyone has been into a school at least once and we all know that "those who can, do, those who can't, teach..."

A headline from *The Guardian* of the eighth of March, 1991, reads as follows:

"CLARKE BACKS PHONICS AGAINST 'CRANKY' TEACHING METHODS"

The article says that Kenneth Clarke, then Secretary of State for Education, *"... gave the heaviest ministerial support so far to teaching children to read through phonics. He derided other teaching methods as 'cranky'... Most of the new methods turn out to be no good at all compared to the traditional one."* (In *The Guardian* a couple of days later (twelfth of March) Glenys Kinnock hit back: *"Somehow the 'real books' phrase has become a term of disapproval... a war cry for the ignorant.")*

What was going on? Was there really a decline in reading skills among primary school children? If so, was it anything to do with teaching methods?

The argument (at least this time around) was largely created by, and based upon, a single but very well-publicised survey reported by a psychologist, Martin Turner, who claimed to have measured a decline in reading skills at primary level. Having done this, though, he went on to attribute it to "progressive" teaching methods. Back to *The Guardian* (eighteenth of March, 1991), however, where an article, headlined "BACKGROUND BLAMED FOR READING SKILLS DECLINE", said that *"A new survey on reading in primary schools will confirm a drop in standards but absolve teaching methods and say the most important factors are family and social background."* The article went on to say: *"Martin Turner... has blamed teaching methods, a*

finding not endorsed by other researchers or by the Commons Education Committee." Mr. Turner turned out, in point of fact, not to know which teaching methods were being used in the schools he sampled! *The Guardian* again (seventh of September, 1990). Mr Turner *"...admitted he had no data indicating which reading methods had been used for the children in the survey."*

The whole debate was, as it so often is, a fine illustration of the power of ignorance to generate hot air. Policy changes were made, and implemented, powered entirely by this hot air. Chalk-and-talk, traditional teaching methods, including especially the teaching of literacy by phonic methods, were enforced in classrooms. To call a teacher "progressive" became an insult!

Perhaps the intensity of the passions expressed during the debate reflects the central position, the pivotal point, that the phonics vs visual dichotomy really occupies in relation to literacy acquisition? If this is so, perhaps the psychology behind the debate deserves cooler and more detailed examination.

Do we read by sound, or by sight? When we examine print, do we see sounds, or do we see letter patterns (perhaps even whole words)? Do we "decode" text into sounds and access its meaning via these sounds or do we decode more directly to meaning, without "hearing" the words at all? Do we "access the mental lexicon" by phonic or visual analysis, to use the jargon?

Language Management (*What goes on?*)

Let us begin with a retreat of one step. Where is meaning? What is a "mental lexicon" and how might such a thing work?

A lexicon is a store of vocabulary, a dictionary. The mental lexicon is thus our mental store of vocabulary, the dictionary in our heads. But what form might this dictionary take? Do we have just the one, with every word filed under its meaning, in sections with related meanings or with very thorough and systematic cross-referencing? We certainly have a very large number of entries and a very rapid access system. It is estimated that we have entries for about fifty thousand words, *not* including derivatives, and can reach any entry accurately in less than three-quarters of a second! (Aitchison 1987)

What follows may seem ponderous and jargon-heavy as we explore this lexicon and the management of written and spoken language on its way to it. On the other hand, I am building up a model of the reading

process and its related cognitive psychology which is central to the understanding of reading and — come to think of it — *all* literacy. From it will follow most of what we can say with any confidence about literacy and the teaching thereof. The model will be invoked and developed throughout this little study. It derives, in the main, from Ellis and Beattie (1986) and I commend it to your contemplation. It is a thing of interest and elegance, as I hope you will shortly feel able to agree.

Figure 2.1 is a simplified outline of a postulated route from speech to meaning. Speech reaches us as a stream of what analysis shows to be astonishingly indistinct sounds. These sounds, nonetheless, approximate to what are called "phonemes". (A phoneme is definable as the smallest meaningful sound unit of a language, a sound which cannot be separated into smaller ones — examples might be d, o & g as in dog, but sh & ch as in fish & chips.) The auditory language analysis area in the brain analyses incoming speech into its constituent phonemes and then goes on to assemble these into the words of which they are part. Now, at this point, the language is being stored as a form recognised by sound, by phonemes. The words are being held in phonemic form, phonemic code, in an auditory lexicon. Each word in this auditory lexicon, each unit of phonemically coded language, can be matched to its corresponding entry in the mental lexicon we envisaged before, where words are held according to their meaning, according to semantics. This mental lexicon we will call the semantic system. When a word's phonemically coded entry in the auditory lexicon is successfully matched with its corresponding entry in the semantic system we can say that the spoken word has been understood.

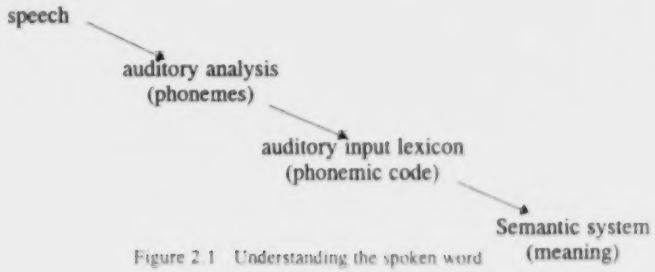


Figure 2.1 Understanding the spoken word

In Figure 2.2 we see an outline model of a route from print to meaning, a suggested cognitive psychological route to understanding of the written word. It works much the same as the previous model in Figure 2.1 — viz. text is seen. The information on the page, approximating more or less closely to graphemes, is sent from the eyes to the visual cortex right at the back of the brain. (A grapheme may be defined as the smallest meaningful visual unit of a language, a unit which cannot be divided into simpler units. Examples would be all letters of the alphabet, but also signs like "£", "$", "%", "5", and the Liverpool Football Club Liver Bird logo.) The visual cortex recognises, after analysis, the letters which have just been seen and assembles them into the words of which they are part. At this moment the words are being held in a visually recognised form, according to their written manifestation; they are in *graphemic code*, stored in a *visual input lexicon*. Each graphemically coded unit, or word, can be matched with its counterpart in the semantic system, and at this moment we can claim that the written word has been understood.

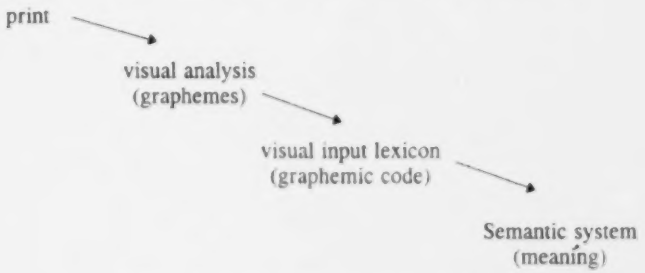


Figure 2.2 Understanding the written word

So far so good. We have a model which postulates routes for the decoding of language-as-sound to language-as-meaning solely by way of its sounds (purely phonically) and also a model for the decoding of language-as-symbol to language-as-meaning purely visually. Of course, as you would, by now, expect, things are not really quite as simple as that! We know that we can also decode writing to sound very easily. We can even decode absolutely new words (or even nonsense), straight from text into phonemes. "Han er en frygtelig fyr" for example. We can also decode phonetically misspelt words to

meaning, via sound. "Hee iz a phawmiddabel phello", for example. Our model, up to now, has no suggested route by which this might happen, no means of reading text and assessing the sounds from it without going via meaning. We need to add a route, in other words, to the model in order to show how we might read indirectly, via sound; how we read phonically, in fact. We need a system which can convert graphemically coded to phonemically coded language and, of course, vice versa. This *conversion link* will be able to explain our ability to read phonically, and also why we sometimes "hear" an "inner voice" as we read silently to ourselves. Our new, latest model is in Figure 2.3.

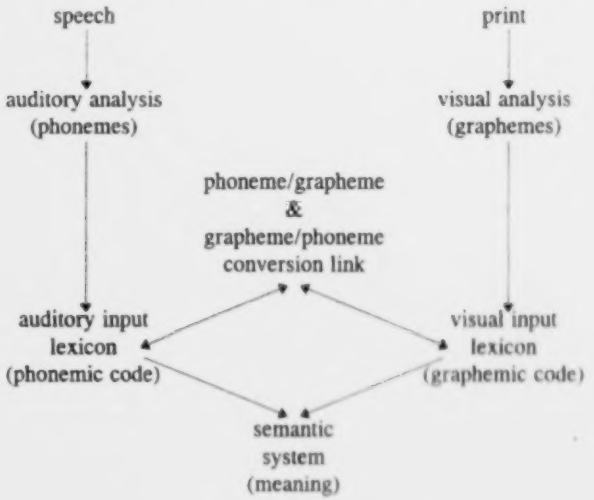


Figure 2.3 Accessing meaning visually and phonically

To return to the point: the phonics vs visual reading debate. We have constructed a model which shows how we may do what we clearly can do, namely to read phonically. We can read print via sound, but do we? The evidence does not show that we usually do any such thing, in fact, merely that we are able to. There is, indeed, masses of evidence that we do not read to phonemes, we do not, under usual reading conditions, read by sound to meaning.

> *"... When a skilled reader fixates a very familiar word, access to its meaning occurs directly from print, with the sound of the word having only a minor role. When a skilled reader fixates a somewhat less familiar word, but one that has nevertheless been encountered before, then access to meaning directly from print and indirectly via the sound of the word may occur more or less simultaneously and in parallel."*
> (Ellis 1993, p. 36)

(See also the Notes to this chapter for some interesting extra evidence that reading is primarily a visual activity.)

Iz reeding fonnick?

Frank Smith (Smith 1985, p. 50) says: *"... rather than phonics making reading possible, it is reading that makes phonics seem to work."* He also makes the points — blindingly obvious once made — that *"Phonics requires reading from right to left"* (op. cit. p. 55) and *"Phonics works if you know what the word is likely to be in the first place."* (op. cit. p. 55)

His examples include the letters "ho-" at the beginning of eleven common words and pronounced in eleven different ways! I give you the "magic E rule" or vowel/single consonant/vowel rule, a widely taught "phonic rule" which states that:

> *a vowel followed by a single consonant and then another vowel is sounded long*

— it "says its own name". Examples would be "cut" becoming "cute", "bit" becoming "biting", "lad" becoming "lady", "not" becoming "notorious" and so on.

What, then, are we to make of home, but some and come; tone but tonic ('phone but phonic, for that matter!); stove but glove; driver but river; tidy but city; likened but literacy; title and titular; pane but panel; patron and patrol; mate, material, matriarch and maternal; precious and previous; secretary but secretory; calamity, celibacy, and celebration; lemon, seven, and evening; metre and meter; idiotic and hideous idolatry; and on and on almost indefinitely? (Just, please, consider the word "inevitability" for a moment!) As a result of such variable phonic irregularity, and the resulting need, as Smith says, to "read from right to left" (or at least, very frequently, to have read the

whole word before being able to utter any of it correctly), please note that you must already have known the "identity" of the word before you could pronounce it. In other words *you had already read it!* You had read it, *visually*, all the way to its meaning before you were able to access its phonemic representation!

Berdiansky et al (1969) (cited in Smith 1988) made a study of the vocabulary spelled by a group of children all around the age of ten. Berdiansky and his collaborators attempted to formulate a set of "phonic rules" which might be being used by the children to achieve correct spellings. They found, in the event, that the children had a spelling vocabulary of six thousand and sixty-two short words of two or fewer syllables, and some three thousand of three or more. They found enormous difficulties in imagining a feasible set of sound-based rules for spelling the six thousand and sixty-two short words and were obliged to give up altogether on the three thousand of three or more syllables, as they added so horrendously to the complications. (The children, of course, were able to manage these words perfectly satisfactorily!)

In the end, they found a hilarious degree of complexity in the rules of a sound-based spelling system if it were even to manage simple spellings. They found sixty "grapheme correspondences" involved in over two hundred "spelling-sound correspondences". They found a hundred and sixty-six rules, but also forty-five major exceptions involving some ten percent of words — and these mostly the commonest. No fewer than seventy-three rules were found necessary simply to cope with the vowels alone. (Remember, we are only talking about very simple and short words!) They did not identify reliable rules enabling any decision to be made as to when a word is to be spelled by "phonic rules" or when it is an exception which must be memorised as a separate item altogether. Frank Smith's conclusion, naturally enough, after surveying this wreckage, was that phonics had *"limited effectiveness at great cost to memory"*. (Smith 1989)

Finding examples (not exclusively in the English language) to demonstrate the unreliability of sound as a guide to the appearance of a word is a little like shooting the proverbial fish in the proverbial barrel. Spotting these "absurdities" is an old game we all enjoy and could play for hours without repetition. Actually, the absurdities are only felt to be absurd because we insist on considering the English spelling system as one which is phonically organised. Our spelling

system does a lot more than merely indicate the sounds of the language, and it is perverse of us to poke fun at it for not doing so at all times. We should rather be grateful for all the other information it gives us, making reading English so much easier (yes, easier!) and so much more interesting. There is logic and history in there, and it helps a good deal. (And see Chapter Four.) Our spelling system is a visual signalling system and frequently sacrifices mere phonetic regularity for meaning or relationship. Consider, for example, the past tense "-ed", frequently differently pronounced but, to indicate its constant meaning, always spelled the same, unless there is good historical reason.

Stubbs (1983) says of English spelling that units which look the same have similar meanings, units which look different have different meanings, and as it is a visual system it often makes visual distinctions at the expense of letter-sound correspondences. Would you really find English easier if it were spelt phonetically? Don't you like the connection between, say, would, could and should to be made explicit as is the difference between would and wood? Would spelling workt, calld, and landid this way help? Would you immediately recognise they were a past tense verb form? Might you confuse landid with candid? What about no and know? What about know and knowledge; medicine, medical, and medication; sign, signal, and signature? Would you find "sine", "signle" and signature sensible; "medisin" and "Medikle"?

One last set of non-technical evidence (and see Notes to this chapter) that we do not read phonically is the fact that we produce the correct meaning even for words which are spelled differently yet pronounced the same, "heterographic homophones" — for example, see/sea, road/rode, no/know, need/knead, and so on. If we were reading to meaning purely, or even mainly, by sound, these heterographic homophones would be problematic. We would experience a falter when reading them. We would be able to read the sound of the words right enough, but how would we know which meaning to allocate to them? Between "so", "sew", and "sow" there is but a visual difference, after all. No, when we read one of these words to meaning correctly we must have accessed the semantic system, in fact, without recourse to the sound of the word at all.

Similarly, we can "disambiguate" words which are spelled the same but pronounced differently, "heterophonic homographs" — for

example, wind/wind, present/present, live/live, read/read, contract/contract, deliberate/deliberate, rebel/rebel, row/row, and so on. If we had not first found the meaning of these words we would not know which way to pronounce them. Clearly we are only locating the phonetic version of the words we read after the reading has already happened. This is almost certainly even what is happening if we hear an "inner voice" while reading, it is simply the onward processing of information which is already safely in the semantic system anyway; simply inevitable spreading activation reverberating round the systems of language management. Even if we do hear an inner voice it is nothing more than a *"... useful second pass..."* (Ellis 1993 (2nd Ed. 1st Ed. 1984))

We read by sight. Reading is a visual activity. We should be glad of it!

> *"Many tutors... have felt that phonic work gave a sound, unequivocal base of skills which could be imparted according to a systematic scheme that would sooner or later sweep up all the problems that a student might have... The common experience, however, is that adults make but slow progress by these methods and usually find themselves quite unable to make the transition from practice-with-tutor to independent use in the real world."*
> (Charnley & Jones 1951, p.11)

Teachers are inherently practical people who like the feel of something solid beneath the feet. Phonics schemes, graded phonic systems, deliver this feeling. This leaves me, at least, with the question in my mind: is phonics really for the benefit of the student — or the teacher?

Chapter Three

Reading: what is it and how do we do it?

Presumably we read by eye, by seeing print? Well, yes and no!

How much of what we "see" is constructed entirely from information gathered in by our eyes and how much is deduced or derived from ideas already floated within our mind? Well, it all depends!

> *"The eyes do not see at all, in a strictly literal sense. The eyes look, they are devices for collecting information for the brain, largely under the direction of the brain, and it is the brain that determines what we see and how we see it."*
> (Smith 1988).

Figure 3.1

Let us play about with this idea a little. Look at Figure 3.1. Many people are unable to "see" what it is. Can you? Stop reading for a moment and look at it. At the end of this paragraph you can find what the original image was before it was degraded. Once armed with this information most people are able to "make out" the figure and "see" the picture. It is a picture of a dalmatian dog. (Roth & Frisby 1986, p.82.)

What was this "seeing" that you did? Did you do it with your eyes or your mind? If it was with your eyes alone, how come you had to be told what it was, and only then "saw" it? The fact is, as Smith says,

your eyes "only" collect visual information; your mind uses this information to "see". Your eyes fix on what your mind has decided is presently important and they record everything at that point indiscriminately, in a completely unselective way. It is your mind which makes a decision as to what it is seeing, your mind which allocates a meaning to it.

In very few instances is visual information simple, clear, defined, and unambiguous. In most real circumstances, as researchers into vision have found to their cost, the information available is disjointed — a fiendishly complex mix of colours, intensities, angles, and surfaces, and, to make matters considerably worse, usually variable from one moment to the next. Most of the images we are presented with (and which we decipher so easily and accurately) are imprecise, with huge quantities of detail, much of which is irrelevant, much novelty, much confusing context and often considerable movement. Equivocal stuff! How on earth do we make sense of it all?

Clearly the mind must be driven at least in the direction of the correct decision as to what it should see by the actual visual information itself, by the incoming data *per se*, by the data arriving from the eyes. If this were not so, of course, we would never be able to distinguish anything from anything else, we would not be able to tell a bean curry from a Book of Common Prayer, by sight alone. The mind's choice as to what is seen is, therefore, at least partly what we can call data-driven, arrived at by force of incoming data. This is also often called bottom-up processing, whereby the raw data at the "bottom" of the process is deemed to be what decides outcome.

However, we can think along a bit and see that our mind has to analyse data and impose a structure on it in order to reach a meaning. Our mind must act on the data if only to reduce it to manageable, understandable amounts. Our mind, though, must do more than just separate relevant from irrelevant data. Indeed, unless it analyses raw data and begins to form hypotheses about what its meaning might be, how will it be able to tell which data is relevant? In considering Figure 3.1 you will recall that, despite a fair amount of visual information, you were unable to reach any meaning because you lacked a good hypothesis but that once you had such a hypothesis to test against the incoming raw data you "saw".

Figure 3.2

Look at Figure 3.2. It is a very simple outline drawing. Read this sentence: "The weather was so hot that we invited the neighbours round for drinks and some snacks done on the barbecue." Stop reading now, for a moment, and consider what Figure 3.2 depicts.

Perhaps you decided that it was a sausage on a fork? Very likely. Suppose, however, I had asked you to read another sentence before looking at the drawing: "Julian's father is in the navy." I believe you would have seen the drawing as a submarine and deduced that Julian's dad served underwater. Obviously, we can be induced to "see" according to mental context. The decision as to what is seen is driven, in part at least, by the concepts knocking around in the mind at the time. We can call this concept-driven, or top-down processing. The mind, in top-down processing theory, is held to be applying an active search for meaning to all incoming data, to be seeking and applying hypotheses to it. This has one very beneficial effect, namely that we can make meaningful decisions based on very partial data — we can "see", even if the information we get is sometimes incomplete or confused, so long as we have some idea beforehand (as we usually do, in fact) as to what the information is likely to be about. So long as we can form a plausible hypothesis, in other words.

"Seeing", then, is a variable mix of top-down and bottom-up processing procedure, matching information from the eyes with that from the mind itself in order to reach the most likely decision as to what is to be seen as swiftly and economically as possible. How much top-down and how much bottom-up processing will be needed depends on how much information we already have in our mind. Once stated,

this is obvious and common experience: the more we already know, the less we need to look for in order to "see". We can put this slightly more technically: the more non-visual information we have (in our mind already) the less visual information we need in order to decide what we have "seen".

Coming through our own home town, for example, we "see at a glance", in very considerable detail, what is going on. In a strange town we are able to "see" much less, perhaps in spite of much more intense looking. The same applies to reading (which is, in fact, not a special visual activity, unlike all other kinds of looking and seeing). When reading a thriller or romance, you can whizz along at high speed, paying very little attention to the print itself, yet extracting detailed meaning from it very rapidly and very efficiently. You know, in advance, pretty well what is coming up — the only surprises will be exactly those surprises you expect from the genre. You bring vast quantities of non-visual information to the task and need correspondingly less visual information. Significantly, this kind of reading is often used as an escape, as relaxation or to kill time, when concentration is difficult and effort undesirable. These are the books you read on trains and in airport lounges. You do not read, in such places and for such reasons, heavy tomes on the effect on systems of government of changing patterns of mediaeval land ownership, the application of modern market research techniques to educational planning in the Eastern bloc or the writing of programs for the assessment and management of fuel requirement in intermediate-distance rocketry. Such reading is much slower and much more demanding. You find yourself, when reading such heavy stuff, paying much closer attention to the print itself (the actual squiggles on the page) — you sometimes find yourself peering myopically, even fiercely, at it! The work may be enjoyable, but it is work all the same and will tire your brain and your eyes. Your imperfect prior knowledge of the subject means that the amount of non-visual information you can bring to the task is limited, and so the amount of visual information you must gather is correspondingly increased. You must examine the print far more closely than ever you did that in the thriller you read on the seven-fifty-five to Waterloo.

How do we read?

When we read text, it feels as if the eyes traverse the page smoothly and continuously, left to right and line by line, without interruption. Examination of the eye movements of skilled readers, however, reveals a rather more complicated process. Our eyes, when we read, are actually stationary for ninety percent of the time, the remaining ten percent being taken up with controlled but jerky movement on to the next pause. The period of sudden movement onward is called a *saccade*, the stationary period between is called a *fixation*. Each fixation lasts about two hundred and fifty milliseconds (about a quarter of a second). Each saccade takes about twenty-five milliseconds (about a fortieth of a second). The eyes are, as you can see, still for about ninety percent of the time we read. We are making just under four fixations a second and the eyes are moving for about a tenth of that time. (As a matter of interest, it is not only during reading that this pattern is observed; when we look around at a new scene, trying to "take it all in", our eyes go into much the same saccade/fixation routine.) A skilled reader clocks in at about ninety fixations for every hundred words read, depending to some extent on the difficulty or familiarity of the text itself. Each fixation, therefore, is covering a single word except that very familiar words may be fixated together with a neighbour and longer, less familiar or composite words (like composite, perhaps) may be fixated at two or more points. Easier, or more familiar, text will require, and receive, fewer fixations. Harder, or less familiar, text will require, and receive, more fixations. It will also produce a greater proportion of backward saccades and re-reading of words.

During a fixation the eye sees acutely over a five-degree scan. In other words it sees more than simply the word it is fixated on. Interestingly, this scan is biased in a forward direction — that is, we see about two-thirds to the right and one-third to the left of the word fixated. (An Arabic language reader, who reads, of course, from right to left, sees the opposite, about two-thirds to the left and one third to the right.) Our eyes are obviously getting a sneak preview of the upcoming text. This will slightly reduce uncertainty and improve speed of decision-making. When reading aloud, if text is suddenly obliterated (e.g. if the lights are turned out) the reader is able to continue for a time, usually to the end of the current grammatical unit (clause, or even sentence). There is evidence that we fixate for longer,

in fact, at grammatical boundaries (where there will be punctuation marks) perhaps to allow the mind to digest and organise material before continuing. The eye, perhaps, marches ahead of the mind which is decoding and recoding to meaning.

So, we have eyes fixating on words yet able to see ahead by another couple of words at least, also perhaps running slightly ahead of the mind's comprehension. This may allow the mind the chance of prediction, of marrying what has gone with what may be upcoming in order to eliminate unlikely hypotheses and suggest likely ones in advance of decision-making time, thereby increasing both accuracy and speed of the decision-making process. (If I put the word *dromedary* into this discussion of reading, it would greatly surprise you. In fact, you would be jolted to a halt and have to look about in the text a bit before deciding it was a misprint, or that I had gone off my head, and (perhaps) continuing. If I write *dromedary* in the context of a discussion of the ungulates in a zoo, of course, it excites no such shocking dislocation. It would, in that context, fit the hypothesis you had formed as to what was going on.)

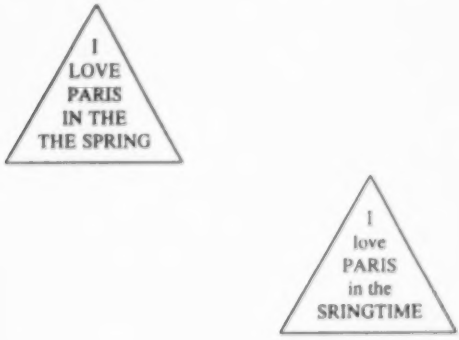


Figure 3.3

Have you read the two items in Figure 3.3? Please stop reading and do so now, if not! Did you notice that in the first the word "the" is repeated, and that in the second the word "SPRINGTIME" has lost its "P"? Most readers do not notice either error and are, in the event,

absolutely astounded to have it pointed out that they were there in the text at all. In precisely the same way, a literacy student, reading back his own sentence to me one evening for the "feel" of it, produced, with absolutely perfect assurance, not once but twice: "it took me years to pluck up the courage to come to the group." He was astonished later to be told that he had twice read the word *"courage"*, although the word he had actually written was *"nerve"!*

Such "errors" are the result of top-down processing; the result of prediction, of the formation of some hypotheses and the ruling out of others. The mind has made its decision based, in large part, on what ought to have been, or might well have been, or probably was on the page, rather than on what was actually there in fact. These decisions are not, of course, errors at all but an indication that the purpose of reading has been achieved — the meaning of text is being accessed without too slavish or demanding attention to the detail of the text itself. This is, by definition, skilled reading. A student reading "courage" instead of "nerve" in the right context and without even noticing should be most heartily congratulated!

Chapter Four

Spelling

"... English spelling is more abstract in its principles than a grapheme-phoneme correspondence system..."
(Stubbs 1981, p.43)

This quote should give us a little hope! Someone, somewhere, appears to see some principles in English spelling. Maybe spelling conventions are not just a haphazard, infuriating collection of irrational irregularities? Perhaps we malign the spelling of the English language as we enjoy laughter, or give vent to fury, at its so-called vagaries?

The spelling of English is, in fact, systematic. It provides the fluent reader with a plethora of extra information over and above the sounds of the language; valuable information relating to word meaning, history, and relationship. The reason why English spelling has gained such a reputation for arbitrary complexity is that it is not, it has to be admitted, a system which is helpful to the early learner.

The English spelling system is, in jargonese, not a pure grapheme-phoneme correspondence system. In plain language, it does not simply represent sounds exactly in characters. The spelling of English is described as morphophonemic. This means that English spelling is more likely to relate to the *morphemes* of which it is made, than to individual letters. It is important that, at this point, we cease to think in terms of letters, and instead begin thinking in terms of morphemes. (A morpheme is the smallest meaningful unit in a language. Mean, -ing, and -ful are all morphemes, though only one is a word. All three are units which carry some meaning of their own.)

The spelling of English is related to the sounds of English, but not slavishly so. If the sounds are predictable, the spelling system is free to abandon the absolute relationship between grapheme and phoneme, between letter and noise, if it is useful, instead, to indicate a grammatical point or relational fact. Fluent readers gain from this, and learners should be told that! Besides, as we all know, pronunciation changes from time to time and from place to place. Spelling cannot be expected to cope with this by grapheme-phoneme correspondences. If it tried to do so, would a Glaswegian be able to

read what a man from Truro had written? Would twentieth-century Truro man be able to read what eighteenth-century Truro man had written? No, we are being naïve and provincial when we expect phonic regularity from a written language of such maturity as English. Let us, instead, enjoy its rich diversity and history, and benefit from all that extra information carried down the centuries to us on those ancient morphemes.

Writing systems vary. Logographic systems, like Chinese, have logographs specific to words. These are highly individual, and spelling, as we conceive of it, simply does not exist. Children take many years to learn the basic vocabulary of literacy as each logograph must be learnèd separately and usually none has relation to any other. Interestingly, of course, there is no problem of phonic representation. The logograph means the word separate from any sound you may wish to use to say it. The two main Chinese languages use the same logographs, so can understand writing in each other's language as perfectly as in their own, while using different spoken words and so remaining unable to communicate verbally.

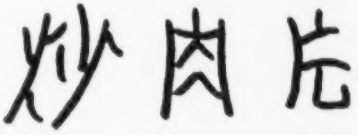


Figure 4.1 Stir-fried meat slices!

Our system is a radically different concept. It is an alphabetic system in which every conceivable word can be represented by an arrangement of (in the case of English) a mere twenty-six characters. The system was never devised; it evolved. Nobody crouched at the cave mouth inventing "i before e except after c..." The writing system gradually developed and an understanding of some of its history is essential, as well as interesting, enlightening, and practically useful.

We live in a "spellist" era. People who do not spell well are despised. The very title "illiterate" is often used as a synonym for "stupid". Spelling ability, however derived, is often used as a guide to general, even completely unrelated, ability. It was not always thus! William Shakespeare, were he to apply for a job today, would be turned down, without ever reaching an interview, on his spelling alone. (He apparently spelled even his own name different ways!) Queen Elizabeth I, reportedly, spelled "but" no less than four different ways on the same page! By the middle of the seventeenth century, however, printing was beginning to stabilise spelling. In the eighteenth century pedantic men like Samuel Johnson compiled their dictionaries (complete with errors!) and the spelling system was set.

Modern English derives, in fact, from all over the place. It stems from Old English but incorporates much more besides. After 1066, and for a couple of centuries, up at the posher end of things if one was anyone one spoke French. Were one to have any schooling one had it in French and Latin. One read legal and religious documents in French or Latin. The people on the Clapham omnibus, or cart, however, went right on speaking English, which was thereby left free for two hundred years or so to develop into the practical, robust, colourful and unconstipated language it is today, freely borrowing from elsewhere as and when.

The pronunciation in these early days was very different from today's, but some hangs on in modern spelling. The final "e" in many words, for example, derives from its original pronunciation. A word like "take" would once have been pronounced "taker" or "taka". After 1066, French spellings were introduced for many English words. The French "qu" crept in so that "Cwen", for example, became "Queen". Latin "regularisation" also often occurred. "Honest", for example, got its "h" (which has always been silent) from the Latin word "honos" (honour) even though it reached English from the Old French "oneste"! Derivation affects word forms too. "Capable" is not "capible" because it derives from Latin "capabilis"; "possible" is not "possable" because it derives from Latin "possibilis".

Some forty percent of "English" words are loan-words, imported from other languages. Some Anglo-Saxon words disappeared but many remained. French and Latin words, in particular, entered the language. We have far greater choice of words today as a result. "Bit", for example, is Old English (bita), "part" is Latin (pars) and

"piece" is French (piece). And we are still at it: "yoghurt" is Turkish, "taxi" French, "potato" Spanish, "ski" Norwegian, "pyjamas" Urdu. Sometimes we have to invent new words: "Diesel" is the name of a German engineer, "petrol" derives from Latin (petra = rock) and Greek (oleum = oil), "television" comes from Greek (tele = far off) and Latin (videre = to see).

Our characteristic posture vis-à-vis English spelling is exasperated mirth, irritation, or even rage and despair. Sometimes, the whole thing seems designed to frustrate you, absolutely personally, does it not? The consideration of a word's history, derivation and/or family connections, semantic or grammatical role can go a long way towards alleviating such hypertensive sensations. It will also fix spellings in the mind, and language in the heart. Always carry a really nice dictionary (I like the Concise Oxford) when teaching, and use it next time a student wants to spell "catastrophe", "charisma", "malignancy", or "vinaigrette".

So now we are in a position to look at the principles of English spelling promised at the start of the chapter. As we do so, we have to think of the morpheme, not the letter, as the unit of written language.

Many spellings are phonically regular and all spellings give some information about pronunciation. (Words like Cholmondeley, pronounced, apparently, "Chumly", and Beauchamp, pronounced "Beecham" are both rare and foreign!) Those spellings which are phonically irregular are either idiosyncratic spellings with a one-off, often historical, explanation or are being spelled in tune to a different beat, often a syntactic or semantic beat.

The word "many" is spelled with an "a" because it derives from Old English "manig". This is an idiosyncratic explanation, based in history, but is helpful nonetheless, particularly if you look "any" up to find it derives from Old English "anig".

Words are often spelled in a way which indicates, unambiguously, their grammatical role, even, if necessary, at the expense of exact sound correspondences. The past tense marker of verbs and the plural marker of nouns make good examples. Houses, sheds and huts have their final segments pronounced, respectively, [iz], [z] and [s]; batted, bowled and watched [id], [d] and [t] likewise. Yet the spellings, because they represent the same grammatical constructs, are the same. The fluent reader instantly understands that a plural or a past tense is being represented; the speller has to learn, for the reader's sake, to

produce it. The reader can distinguish at once that "feted" is the past tense of something while "fetid" is not. (And is, presumably, why ambiguous patterns like "freed" are slightly shocking.)

Words which seem phonically irregular in one form are often regular in another. The classic example of this is all those -sign words of similar derivation, sign, resign, design, assign. They are all irregular, with their silent "g". However, they all have forms with a sounded "g" — signature, resignation, designate, and assignation.

Units (morphemes) which look the same probably mean the same, those which look different probably don't. Phonic variation, if it is regular, may not be exactly indicated by spelling which may, instead, make visual signals which provide extra grammatical or meaning-related information. Units with related meanings or derivations share common spellings, and at least one of these will probably be phonically regular.

It is important that we understand that spelling and reading are not two opposite, mirror-image parts of the same activity. They are radically different. Reading is, after all, the decoding of someone else's writing. It is a flexible linguistic activity, much to do with prediction and analysis. Reading allows for alternative "guesses" while still remaining "correct". Readers can use context to predict outcome. Spelling is quite different. It is encoding your own ideas, and is largely a motor skill. It is quite inflexible — it is either right or wrong — and allows for no alternatives (except in a very few instances). Spelling cannot be predicted or confirmed from context, it must be produced afresh. This production has little, as such, to do with the language it is intended to represent. Reading is, in short, a complex, analytical skill while spelling is a simpler, recall, and motor skill. Reading is confirmed by the sense it makes, spelling does not make sense and is confirmed by detailed visual inspection and memory.

In previous chapters, I hope, I have convinced you that we don't read phonically. Reading is not primarily done via sound (though it can be as a secondary, fall-back technique). We read by decoding text direct to meaning, through the visual analysis system. I hope you can see that exactly the same arguments can be deployed to show that we spell directly, in the same way, through the visual analysis system. We do not assemble phonemes, translate these to graphemes and thence to writing (or typing) movements. We take language directly to grapheme code and on to text. (We do not make the sounds of words

in our heads and use them as spelling template or guide — we spell direct from meaning to letter or letter pattern.) What we are talking about here is the bottom half of the diagram of language management last seen in Figure 2.3. (The whole thing is in Appendix 1.) The diagram in Figure 2.3 represents the management of incoming language, speech or text, through to meaning. The following diagram, Figure 4.2, represents the management of outgoing language, going from meaning to either speech or text. (See also the Notes to this chapter for evidence that we usually spell visually.)

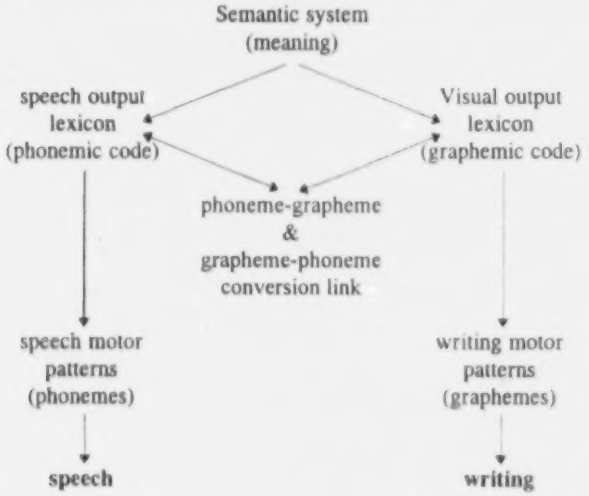


Figure 4.2 Producing speech or writing from meaning.

Language, held in semantic code, as meaning, in *the semantic system*, can be made to activate its graphemic code representation (its representation as visual symbols) in the *visual output lexicon* (the mental store of language as symbol) and thence its representation as those motor patterns which will cause the hand to produce its representation as letter patterns on paper. This is visually mediated, direct spelling. It is the usual way fluent spellers do the trick.

There is, however, as there is with reading, a back-up possibility using the phonic, sound-based system. It is, after all, possible to write

new or nonsense "words" for which we can have no entry in any lexicon; "bosticlop" or "spinkleduff" for example. It is, obviously, possible to activate a sound and translate it into lettering. We are back at the idea of a *grapheme-phoneme/phoneme-grapheme conversion link* system as seen first in Chapter Two, in connection with reading. Language can be activated as phonemic code in the *speech output lexicon*. This can be used, via the phoneme grapheme conversion link, to activate graphemic code representations in the *visual output lexicon* and thence to writing, as before. This is indirect or assembled spelling. It is, as is phonemically mediated reading, a roundabout way to the goal. It is also, as with reading, a commonly experienced secondary event through the phenomenon of spreading activation. (It can *feel as if* we are spelling by sound even when we are not, as phonemic code representations are secondarily activated.)

So, spelling is normally managed directly, visually, via the graphemically coded system, without reference (except perhaps secondarily) to the phonemically coded system and the sounds of the spellings. Spelling by sound is optional, spelling visually is usual.

This matters in the same way, but perhaps more so, with spelling than with reading because students have a (sometimes regrettable) tendency to listen to their tutor's advice! If a student is consistently advised that spelling and reading are managed primarily by sound, and that phonic attack is the optimal route, that spelling and reading should be attacked by sound, he (or she) may try always to do so, with long-lasting results. Spelling and reading will be for ever mediated indirectly, through assembled spelling pathways, by sound, round the conversion link. Such indirect psychological pathways make the establishment of good links (in a word, learning!) that much more difficult. Such unnecessary complication, the involvement of so many extra representations for each item, will produce the characteristically slow and patchy success rate seen so commonly in the literacy class. We shall have turned a straightforward and direct psychological task into what is so often the definitive literacy experience; an apparently obscure, complex undertaking only fitfully illuminated by either success or understanding and almost never by real confidence. The "learning curve" will be a flattened and lumpy thing. Learning will not "stick". Literacy will not, ultimately, make sense! Students will experience those familiar feelings of frustration, guilt, and stupidity so frequently 'normally" associated with literacy tuition...

Chapter Five

Literacy and Andragogy

Another of those words with which to impress the dinner guests, or frighten the dog, "Andragogy", is the teaching, specifically of adults (as opposed to pedagogy, for instance, which is the teaching of children). (Greek agogos = guide; pais, paidos = boy; andros = man — and don't blame me for the sexism!)

Martin (1986) provides a concise account of Malcolm Knowles' theory of andragogy. It is required formal background, of course; for "basic ed.", perhaps more than most "ed.".

According to Knowles, there are four major differences between adults and children, in the educational setting. Adults have (i) a stronger and more independent self-concept; (ii) more experience; (iii) a more palpable desire for education to be immediately relevant to life away from the classroom; and (iv) a wish to learn which is motivated by maturely perceived need arising from the aforementioned life outside the classroom. Adults, in short, have a better idea of who they are, of what they want, and of what they want it for. Adults are usually not motivated to learn by fear, compulsion, or duty. Adults want learning to be problem-centred, rather than subject-centred because, for most adults, learning is motivated by "real life". Adults, in other words, want their learning to be aimed directly at solving a rather specific problem (spelling, for example). Adult students in adult literacy classes are, at least in my experience, not usually (unlike, probably, their tutor) at all interested in the subjects of literacy or linguistics, for their own sakes. (If you do not believe me, try embarking on a discussion of, to you, the deeply fascinating probable psychology behind such and such a spelling or linguistic error. Eyes will glaze and wander, fingers will fidget, watches may even be surreptitiously checked.) No! On the whole, we can say that immediately practicable learning is sought in response to immediately felt needs. I think we can add that adults in the literacy class have very little love of, or desire for, the process of "education" as such, at all.

Because of all this Knowles insists that a *"climate of adultness"* be deliberately engendered in adult education. Adults must be involved;

they must participate, from the very beginning and consistently thereafter, in the "diagnosis" of their own needs, their own deficits, the planning of their own learning, the process itself, and the evaluation thereof.

Because adults can employ such insight into, and control of, procedure and because of their wide experience, general methodology must centre on the student, explicitly valuing and using such experience. Method must respond to identified real-life needs and provide prompt, practical, problem-centred learning. Success is vital. Material must be pitched at a level, and delivered at a speed, at which a student is adequately challenged yet generally successful.

Reeling off these requirements all at once, in a great list, makes it seem that only "Supertutor" could possibly deliver. There is, however, a widely used general approach by which these demands may easily, satisfactorily, reliably and consistently be met. Most of you probably, at least intermittently, practise it. What I am talking about is the good old basic "Language Experience" method. (And see Chapters Six to Eight for some "nuts and bolts" methodology.)

Language experience (apprenticeship) method is really stupendously simple. It makes tutors' lives easier and students' learning far more productive. It is simply the practice of using students' own material as source material. This means that the tutor turns up for class with very little, other than ideas and method, prepared to do little more than facilitate learning. The student will do the work. Ideas and methods will be appropriately applied to whatever material the student brings, or produces there and then.

Using language experience is a scary experience at first. It feels irresponsible in some way, as if all control and direction has been abandoned. It seems nebulous and unreal, not really "method" at all. For an inexperienced tutor, coming to class with next to no material prepared in advance feels like having no ground under the feet. It feels enormously risky, as if the session might suddenly run aground, as if there might suddenly be nothing to do except to gawp at each other in embarrassment and horror.

Have no fear, or have less fear anyway! Most tutors, if they were being honest, would tell you of carefully-prepared sessions which just don't work; of evenings when you decide to "tackle" vowel digraphs or some such. You devise what seem to be meticulous, painfree, and cunning "lead them to it" exercises. You write, perhaps, a really nice

little dictation full of whatever it is you want to teach. You make, maybe, a small list of suitable spellings and invent some lovely little drills to teach them by. You display these gorgeous wares with great professionalism, one after the wonderful other. You work dextrously through the various oh so artfully constructed and well-fitting exercises. To your astonishment, however, there is manifest failure, a palpable resistance from the little grey cells sitting opposite. The session does not "gel", stick, or enthuse. Clearly, nothing of value has taken place. Both sides of the contract get up feeling that they have disappointed and been disappointed. Everyone feels a flop. On bad nights there is despair all round.

What has happened? "Good method" has been abundantly used, and you know for a fact that the student "needs work on" vowel digraphs (or whatever). Why has it failed to excite, to motivate? It all seems very odd! The fact is that stuff devised by someone else is almost never on target, almost never really appropriate, relevant, personally meaningful, or at the right level or speed. This is why all those exercises in "schemes" never quite work. They never will.

A student's own work is, almost by definition, at the right level and will inevitably be problem-centred. It is certain to be relevant, interesting, and motivating. It will be full of demonstrably pertinent and absolutely obviously personal needs. It is unnecessary to lie awake staring up into the dark and worrying about what content the next session should hold. You should try to make yourself, instead, recognise that everything a student needs, every "spelling pattern", grammatical construction, writing skill, will turn up in due course. Not only will it all turn up, it will do so at exactly the time when it is at its most relevant and learnable. (If it doesn't turn up, of course, it wasn't required!)

Language experience is student-centred. It validates experience and provides, for a tutor, a ceaseless source of obviously and immediately relevant teaching material. It enables the basic principle that teaching should proceed from known to unknown to be followed without strain, anchoring tuition in prior knowledge and keeping within shouting distance of it always.

Every student has a history. A specific language experience method, which is worth special mention as it can have such deeply advantageous effects, is the gradual production of a personal history in written form. Consideration of, and writing about, past experiences,

particularly in respect of literacy, can be very cathartic and productive. It may not be easily accessed, buried under years of dissimulation, but it will be worth the search. Every student has a story to tell; many have some extraordinarily bitter ghosts to lay. The ghastly phantoms of failure, guilt, and resentment, once the student has pinned them onto paper with his or her own words, are permanently immobilised and may be thereby reduced to more realistic proportions. Some highly motivating and exciting material may also be produced. Truly moving and germane records may emerge, worthy of wider publication. (See Appendix 2, as well as "Where do we go from here?", Gatehouse project 1983)

Confidence is the really big idea. Students in adult basic education may, at least in respect of literacy and the literate world, have very powerful feelings of stupidity, incompetence, inferiority, failure, guilt, resentment, even anger and hostility. As with us all, this destructive cocktail may be more or less buried and can become a complicated, apparently inexplicable, block to learning or the establishment of the kind of environment and relationships which enable learning. The overall aim of tuition has to be the cultivation of a free, confident, and autonomous attitude in the mind of the student towards literacy in general, and its use in the real world. Tutors have to be demonstrably capable and interested, reliable, discreet, honest and open — consistently and forever. A lot of learning technique can be psychologically risky and potentially embarrassing — construable as silly, and unavoidably open to yet more fairly public failure. (For some discussion of confidence at a more technical level see Notes to this chapter and "signal detection" theory.)

Failure, as a subject in its own right, is worth some attention. Some failure is inevitable, and not only for the student! It is also highly desirable, of course, as the source of language experience material for probably the most valuable work you will ever do. Patterns of error should be openly analysed, and information thereby gained explicitly worked into mutually agreed methods. Failure, as an activity, should be discussed along with practical, technical, and psychological coping methods. (Some students appear, for example, to believe that "literate" people never fail at literacy tasks. Eradicate this idea promptly! Never hesitate to let inability to spell something, or errors in writing, show. If you need to refer to a dictionary, for example, let your student observe your need. In particular, the

discussion of failure in the context of writing should include demonstration of the enthusiastic use of a waste paper basket!)

Adults in literacy class may have either an overtly hostile, or an overly deferential, attitude towards their own language. Their own language, however, is just that: their own language. Students should be enabled to reclaim ownership and rights over the English language. Linguistic questions (providing, of course, that they arise from the student) should be answered properly — researched, if necessary.

"Internalisation" is another big idea. That time which students spend actively assimilating and consolidating learning, without any "help" from you, is never wasted — it is golden. The notion that students are like cuckoo chicks, into whose maws tutors must be seen to be continually and excitedly cramming esoteric input, is mistaken. It is probably true that teaching is impossible; that only learning is possible, and that teaching is "just" the provision of an environment in which learning can take place. There are frequent occasions, therefore, when a good tutor paints himself or herself out and allows the student who wants to get on with learning to do so in peace!

Chapter Six

Learning to Read

Frank Smith says simply: *"Children cannot be taught to read."* (Smith 1985, p. 5)

At first sight this seems a depressing and pessimistic surrender, but it is written at the start of a positive account of how children — if we refrain from actually preventing them — learn to read easily and painlessly. By page ninety-four he is writing:

> *"We learn to read by reading."*

"The teacher's problem is never the lack of advice." (Smith 1985, p.3.) There is a plethora of practical, "now-do-this" kind of guidance available and I wish to add very little. My intention is simply to make a better join between the hall carpet of practice and the kitchen tiles of theory; to have a look around the kitchen while yet remaining out in the hall. We don't want to be laying carpet in the hall that doesn't match the kitchen tiles, do we?

May I go back over the theory discussed to date? You will no longer be surprised to find me quoting Frank Smith.

> *"Words are recognised in exactly the same way that cats and dogs, cars and faces... are recognised. Words are recognised... on the basis of distinctive features."*
> (Smith 1985, p. 112)

In Chapter One we saw that language management takes place in rather specific areas, usually in the left brain. We explored the idea of cascading analysis, with bottom-up processing providing raw data on which top-down processing can operate. Top-down processing enables us to make sensible decisions very fast even with rather little hard information. We form hypotheses and then we search incoming data (by minimal cue detection and feature analysis) in order to challenge or confirm these ideas. We can perform these cascading analyses simultaneously at a myriad of interconnected points. Our computing power is formidable. How rapidly and accurately we recognise all those *"cats and dogs, cars and faces"* for instance! We saw that the language unit we analyse to meaning is probably the word (though

may even be the clause and certainly is nothing as small and insignificant as a letter). We should not be surprised that our system can cope with analysing so many words by simple feature analysis — we do it, with other objects in other contexts, all the time.

In Chapters Three and Four we dealt with some theory of reading *per se*. We discovered that fluent readers do it visually. Fluent readers only use "phonic mediation" as an alternative, secondary, back-up reading method when faced with something like Ordovician, Habakkuk, or Zbigniew. We saw that reading, as a cascading, top-down and bottom-up visual feature analysis procedure, is a mix of visual and non-visual information. We saw that the eyes, fixed for ninety percent of the time we are reading, see several words at each fixation — the brain thereby getting advance notice of upcoming text all the time. We saw that the mind, when reading, is extracting meaning and is capable of "seeing" things which are not on the page at all, of "seeing" things differently than they are on the page and of not "seeing" things at all even when they are clearly on the page! Meaning can, in fact, altogether override the raw data provided by the senses (which is why proof-reading is so difficult. Perhaps you recall the "I love Paris in the the spring" and "I love Paris in the sringtime" experiment in Chapter Three? Precisely because you made sense of the text, found its meaning, you probably altogether overlooked the errors in even so small a sample of the stuff! Proof-readers have to learn not to read to meaning, I guess. If they ever got "caught up in" text they would begin missing the errors it might contain.)

In Chapter Five we looked at the theory of andragogy; at the centrality of the student and the need for a *"climate of adultness"*. We decided that adults are adult, and know what they want and why. They are problem-centred and practical. We produced two big ideas: internalisation and *confidence*. (We "proved" the need for confidence in the notes to Chapter Five using Signal Detection Theory. We said that reading speed was very important and that at reading speeds below about two hundred words a minute meaning begins to be lost. Confidence and the willingness to risk an error were seen to be crucial to building up reading speed.) I wrote that a nucleus "Language Experience" approach would consistently and reliably provide meaningful, challenging, achievable, personal, problem-centred and participatory grist for any student, at any level.

Language experience is nothing more than the consistent use of the student's own written language as source material for tuition. Students' work can be used for reading, spelling or writing exercises, as well as linguistic discussion. It builds up into a resource which is acceptable also for other students. It is often published. (See Appendices 2 and 3, and "Where do we go from here?", Gatehouse 1983.) Material other than student's material is often either infantile, grotesque, or just plain dull. Stuff specially written for "easy reading", or with "special vocabulary", is often moronic as a result. One researcher found, unbelievably, that an early reader scheme made as much sense read from back to front as it did if read the right way! Tony Martin, on the subject of remedial texts, says:

> *"Their language... had been so pared down and simplified that only the words remained."*
> (Martin 1989, p.56)

If you are not using students' material, use text you like because it is well written and has a point to it. Some texts, even so, are a lot simpler in vocabulary and more direct in their language while still being good stuff. Roald Dahl's short stories are an excellent example of this — adult and well constructed, yet simply written. They are good "read-along" material (see later in this chapter). (See also Notes to this chapter for assessment of text "readability".)

There is a large amount of specific reading method in the literature, so I shall tell you about little of it here. I must mention the very valuable Paired Reading method. (You should, if you have not already done so, read three important authors on reading. One is, of course, Frank Smith. His book, *"Understanding Reading"*, is where to start. It is a brilliant bombshell, even if you don't swallow it all whole. On the "apprenticeship" approach to reading read Liz Waterland's lovely little *"Read with me"*. Andrew Ellis' book *"Reading, Writing and Dyslexia: A Cognitive Analysis"* is wonderful. For *How-to* guides, the ALBSU booklets, and NEC's *"Basic Education 16-99"*, are very good in parts!)

Paired Reading

Paired reading (or shared reading) is part of the "apprenticeship", student-centred approach (see Waterland, 1988; Campbell, 1990; Young and Tyre, 1983). It goes something like this:

Student and tutor may discuss the reading before starting — likely awkward words or names, style, and intent of writing, likely audience, etc. The idea is that, other things being equal, once the reading begins it is not interrupted. Tutors must be positive about this exercise; as with so many other things in life, first attempts may feel like foolishness and end in a degree of failure. The idea (reading with support, for meaning and enjoyment above all else) should be carefully explained to the student at the very outset. Paired reading is worth some persistence until perfected. It is a gently and generously supportive reading technique which can stretch a student fast, far and painlessly. It can also, on occasion, be taught to students' family members so that it can be used away from "class". It not only teaches reading *per se* but also the point and pleasure of it.

Here is a suggested procedure:

1. The student and tutor choose a text of suitable level — perhaps something produced by the student in question, or another student's work.
2. Student and tutor read aloud, together. The tutor should aim to support, not to lead or dominate, and should ideally be reading a fraction *behind* the student.
   If the student hesitates the tutor promptly provides the word.
   If the student makes an important error the tutor promptly provides the word, the student repeats it, and the reading continues (perhaps back at the beginning of the sentence, if meaning is likely to have been lost).
   The whole point is to keep the flow going and to read to meaning. The activity should be easy and enjoyable.
3. If all is going well, the student may signal for the tutor to fall silent and may read on alone and aloud. The tutor remains silent unless important errors or major hesitations creep in, in which case supportive co-reading should begin again.
4. And so on.

Read-along

"Read-along" is a home-made variation of *paired reading* of my own, for use by the workaholic student who wants to carry on paired reading alone! Short stories, novels, or whatever suits, are read, by the tutor, at moderate speed, onto cassette tapes. The student borrows

both tape and text, and reads the text while listening to the tape. I believe the technique is valuable but have some provisos. My "moderate speed" turns out to be around a hundred and fifty words a minute — this may be almost too slow for reading to meaning. I am also not certain that it is possible to read to meaning and listen to a tape at the same time. Students assure me the technique works, but they would, wouldn't they? (Students being notoriously loyal!) However, at the least some lovely stuff has been read, or at least heard; from Roald Dahl's stories and "Revolting Rhymes", via Kurt Vonnegut, Somerset Maugham, Ruth Rendell, James Thurber, and many others, to the manual for a welding machine!

"Flash" Techniques

There is a trend towards repudiating all "drill" techniques, but perhaps the baby is being thrown out with the bath water? *"Social sight" vocabulary* offered *in context* is enabling. ("Social sight" vocabulary is that vocabulary we all have to use for daily survival. It includes signals like "gents" and "ladies", "sale", "Emergency Exit", "No Entry", "Push" and "Pull".) It can be worked into thematic groupings such as road signs, work-related signs, travel-related signs, shopping signs, etc. I have tried showing, as flash or otherwise, colour slides of such vocabulary as it appears *in situ*. When showing them as "flash", I intersperse each slide with a blank (you get at least one blank with every film developed!). Banging a slide (of, say, "NO UNAUTHORISED ENTRY") up, followed by its swift replacement by a dark screen, has, I believe, done wonders for the use of "visual memory"; for the skill of looking closely and accurately, within the mind, at what the eyes have seen, for meaning. Photographs might also be used. (It makes a pleasant, unharrowing break as well!)

The "keywords" have, it seems to me, such an important position as to be worth special and deliberate learning effort, either as read or written words, perhaps especially as read words. (The keywords are the most commonly occurring words in naturally produced language. Many tutors use the first hundred as specially useful, by virtue of their amazing ubiquity. The first dozen words make up no less than twenty percent of our language use, the first hundred make up fifty percent!) Students are adult and, once the ubiquity of these words has been demonstrated to their satisfaction (as it should be; try counting with your students the number of times the first twelve occur in a hundred

words of any magazine article), they will happily buckle down to a bit of rote learning for such a prize. Place them (the keywords, I mean) on cards for example, in good, clear writing and show them in random order as a flash exercise or otherwise. Perhaps every student should have a set for use as reading homework? They will, by definition, turn up all the time in language experience spelling work.

The first hundred "keywords" are:

> in, was, is, I, he, it, a, the, that, to, and, of.
> are, for, you, had, so, have, said, as, not, they, with,
> one, we, on, his, at, him, all, but, old, be, up, do, can,
> me, came, my, new, get, she, here, has, her, will, an,
> no, or, now, did, by, if, go, down, just, out, your, into,
> our, went, them, well, there, were, big, call, back,
> been, come, from, only, first, off, over, must, make,
> more, made, much, look, little, some, like, right, then,
> their, when, this, two, see, about, could, before, other,
> which, what, where, who, want. (See also Appendix 5)

Frank Smith is probably right when he asserts that people cannot be taught to read. What we can, and must, do is to get out of the way of people who are learning to read. The way we learn to read probably is by actually reading, by being exposed to successful reading. Tutors have to manage this positively, and introduce reading in such a way as to inculcate visual attack rather than phonic attack. The student who believes reading is a matter of "sounding it out" must be helped to develop visual reading as the primary, dominant technique; to develop the skill of looking for letter patterns rather than noise written down. What is needed is plenty of reading practice at good speed (paired reading, perhaps, or "read-along") together with a firmly and enthusiastically visual approach. It is, ultimately, like learning to ride a bike — you can't be taught it. All you need is someone to support and encourage you long enough for you to learn. Once you have the basics you can improve alone, and cycle wherever you want.

Chapter Seven

Learning to Spell

Spelling and writing are probably the backbone activities of literacy tuition. Good practice develops from good theory. To summarise, therefore:

English spelling infuriates us, largely because we insist on looking at it through the wrong expectations. English is a language "of a certain age", with a romantic and cosmopolitan past. The history of words (Etymology, for those with their teeth in) has a major influence on spelling. *Principles* have also evolved. English spelling is semantically and grammatically rich; sometimes absolute phonic regularity is dropped in order to achieve this. Even so, all English spelling provides considerable phonic information. *Nil*, in fact, *desperandum*.

Fluent spelling is primarily a visual, not a phonic, activity. Spelling is usually produced directly to writing via the *visual output lexicon*. Spellings are directly associated from semantic to graphemic code, and are stored in the visual output lexicon as graphemically coded units. (see Appendix 1)

Spellings can also be produced via sounds, though this is usually only a secondary, alternative, back-up system. To do this, the semantic representation must activate the phonemically coded representation of a word, in the *speech output lexicon*. From the speech output lexicon the entry in the *visual output lexicon* can be associated via the *phoneme-grapheme conversion link*. This is a secondary, indirect route, but may tend to happen anyway (remember spreading activation?).

In other words, we sometimes "hear" the sounds of our language as we read or spell it, even though we are actually doing so visually. This "inner ear" is evidence not of phonic management but of *spreading activation* secondarily activating the alternative system available. I hope enough evidence has been provided earlier in this book to demonstrate the *absolutely cardinal principle*: the psychological pathways for the management of language in its visual manifestation (text) are primarily visual. *Reading and writing are primarily visually managed*. It follows that teaching/learning methods

must be biased towards visual method, and explicitly so. This truth is often attacked by rock-headed parliamentarians, and psychologists with axes to grind, and cannot be overemphasised!

So: what might visual method look like?

Language experience is the approach of choice. A student's writing can be trawled for important or relevant errors. (See Appendix 4) These are then learned as visual patterns, if possible with two or three other common or relevant words which contain the same letter pattern, even if they make different sounds. The learning itself is done by eye and hand *(visuo-motor learning!)*. The method I have found to deliver the fastest, longest lasting, and most profound learning derives from the justly famous Fernald "Look, Cover, Write, Check" method and the not-so-famous Gillingham and Stillman "Simultaneous Oral Spelling" methods (the "LCWC" and "SOS" methods, as I shall hereafter refer to them. The SOS method can be found in Kirk (ed) 1983, p. 247-250)

This is all probably best explained by example. Suppose a student misspells "wined" as in "wind up a watch" (or does nobody do that any more?). A card is taken and filled in as follows:

- The visual letter pattern to be learned ("ind") is written clearly in the top left-hand corner.
- An indication of how common the pattern is written in the top right-hand corner. (This might be a system of stars, for example, five meaning extremely common or relevant, one very rare or irrelevant. This gives the student useful information when any revision is done.)
- In the body of the card a short list (no more than about five) of relevant or common words containing the pattern, regardless of sound, starting, of course, with the word originally misspelled.

The card might finish up like this:

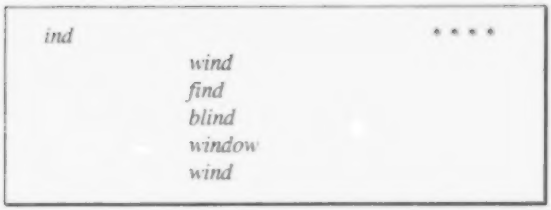


Figure 7.1 A visuo-motor learning card for LCWC/SOS.

Now it is the student's turn, and the card's spellings are learned. (Do not let your student imagine no work is involved in tuition!) This is *invariably by* the ***LCWC and SOS*** methods, so:

L The student looks at the card (maybe one word at a time; the lot if feeling frisky) until satisfied that the spellings can be reproduced.

C The student turns the card over.

W The student writes the word(s) *using the SOS technique* and (either if satisfied, or failing and starting again)

C Turns the card face up to check the spellings).

SOS — The tendency is, when spelling, to say the sounds of the word aloud. This must never be done, for two reasons:

1. It would be reverting to phonics and training the student into spelling via sound as the main method

and

2. hand and voice get straight out of synch with the result that the student finishes up saying one thing while writing another. (Try it!)

Instead, when a student is learning a spelling, he or she should sing out (yes, preferably aloud) the names of the letters as they are being written. Thus "wind" is learned as *"double-u — eye — enn — dee"* and not as some weird noise. (You try saying "wind" very very slowly!)

This is the *visuo-motor method*. Spelling visibly makes more sense this way, and it really sticks. The student, of course, gets the card to keep. Cards build up into a formidable learning resource which can be used anywhere, anytime, and for as long or otherwise as the student wishes. It places learning into the student's own control. The only

proviso on their use is, of course, that the LCWC/SOS method is rigidly adhered to even when not under a tutor's vigilant eye; no student is ever allowed even to think the sounds of a word as he or she spells it!

For a method not of teaching spellings via sound but of "tuning up" the accuracy with which listening is done (an essential skill for the first attack on absolutely new spellings), *"Listening Skills"* can be found in the Notes to this chapter.

Of course, there are many methods of attacking spelling which are perfectly valid. I summarise these in Figure 7.2 below. Students should be encouraged to go ferreting around looking for history or relationships, for the difficult and the easy bits, for the meaningful bits and the various patterns, even for sounds which may be helpful. Confidence is crucial; study good failure technique (see Chapter Five) and how to use varied, positive, and purposeful methods of attack. In other words, give the student informed control over learning and the feeling that it is possible by a variety of routes.

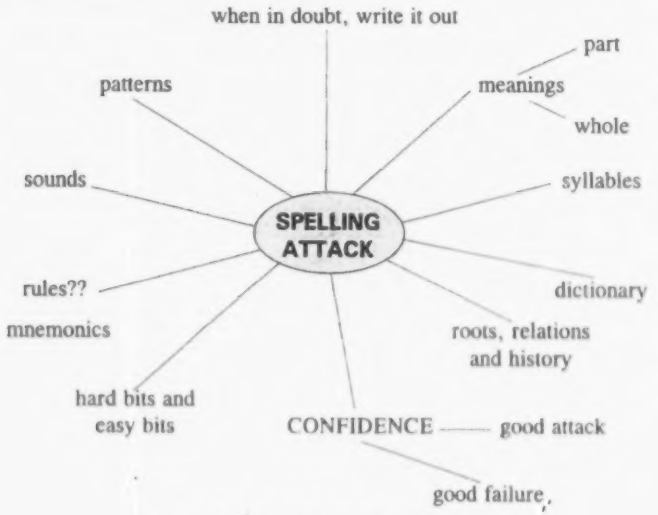


Figure 7.2 A mind map of spelling methods

I hope this mind-map is self-explanatory. The more ways students have to attack spelling the better. You may well be able to add more, but can I urge you to beware of "trick question" methods like, for example, the defusing of anagrams, etc. These cause perspiration rather than education to occur. Always play with a straight bat. Only ask a question if the answer will actually reveal something desirable and something which the student is actually able to produce. On methods of teaching/learning spelling read Rhiannedd Pratley's *"Spelling it out"* and ALBSU's *"Introduction to literacy"*. (Avoid Hornsby et al's *"Alpha to omega"*. You may find this difficult to do, as it is everywhere, and seems to offer the kind of tightly controlled material which is likely to seduce the nervous tutor.)

One routinely used and much loved method no longer seems valid to me and I have therefore awarded it a double question mark on the mind map. It is the use of "spelling rules" as overt method. I no longer want students to "know" any rules at all. This applies to phonic and non-phonic rules alike. (Actually, all I want to say about "phonic rules" can be summed up as *"Rools: ar thay enny uce?"* But are "non-phonic rules" any better?) We all know how exception-ridden rules of spelling almost always are. We know almost none of these rules anyway. However, my critique of rules is much more general. I think they are actually counter-productive. I think they make the acquiring of real writing skill much more difficult. I think spelling rules are disabling.

It is true that, by and large, spelling by rule "works", in the very limited sense that on occasion a correct spelling can be produced by the application of a consciously consulted rule. (Though there is no rule to tell you when not to apply a rule.) Spelling which is very poor can be somewhat improved by learning and applying rules. The aim of literacy tuition, however, has to be more than merely teaching the skill of producing correct letter patterns to order. Such a skill is, in itself, rather futile. It is certainly not synonymous with writing. Good spelling is assuredly not the same as good authorship. Literacy teaching, if it is anything at all, is the development of a seamless relationship between a mind and its written language — the ability, for example, to write without "spelling" at all, just as you and I do all the time.

Really fluent spelling, spelling which is unconsciously managed, spelling which never disturbs creative thought, unconscious spelling

which leaves the writer free simply to "write", such absolutely effortless spelling is not performed by rules at all, I believe, not even subconsciously applied rules. Spelling is, I believe, carried out by the association of patterns in the mind, by a memory for letter patterns, and patterns of letter patterns. If this were true, then the learning and application of rules is just an unproductive and irritating intrusion between the writer and the word. If writing is the subconscious remembering of associated patterns, then any conscious thought about spelling is pure distraction.

Rools: Ar thay enny uce?

I was long ago struck by what I call the *"i before e is no help* to *me"* effect in my own writing (I only really remember one spelling rule, how many do you?) and have observed it clearly operating when others have been writing. I notice that I can correctly write, without giving spelling a single (conscious) thought, a whole lot of my language including all sorts of irregular and unusual letter patterns until I meet a word containing an "i" and an "e", juxtaposed. Suddenly the whole writing process has to stop. I have to leave creative-writer mode and go into how-is-this-word-spelled mode. I find, and repeat, *"i before e, except after* c... I decide whether they are after c or not, and so which way about the wretched letters have to go, and write them down. I switch off the spelling mode and try to get back into writing; into just thinking. It is an infuriating, muse-eradicating nuisance! This subjective spelling experience of mine is consonant with modern thinking in cognitive psychology.

Is there any alternative to learning by rules?

Our mind, our cerebral cortex, contains some eight billion "little grey cells". Each cell makes thousands of connections with other cells. Such connections can be excitatory or inhibitory and can vary in the strength of signal they will pass; they can be weakly or strongly "on" or "off". With such elaborate connections, in such unimaginable numbers, fantastic and various circuitry, in huge quantity, can be built.

One model of possible circuitry is the "pattern associator". A pattern associator is only a small network of brain cells, but their interconnections enable one pattern to be instantly associated with another. A picture of a rose may, for example, immediately evoke its scent. It is easy to see how a pattern associator would function in

language management, instantly translating, say, language-as-meaning into language-as-letter patterns. (For a further discussion of pattern associators see Notes to this chapter, also Rumelhart & McClelland's excellent double volume on *Parallel Distributed Processing, 1986.)*

Much cognitive psychology has, in the past, visualised the mind as a large computer. With this paradigm it was impossible to see how the mind could do so much, so fast, in so many areas of cognition all at once. Computers, you see, deal with stuff very quickly, but in a *serial* way: do this, then use the result to do that, then go on to... and so on. We are much smarter than that. We almost certainly work in a *parallel, distributed* way. We probably don't work like one, but like a whole lot of computers all able to function independently, and yet intercommunicate, at the same time. We can do lots of different things, all over the place, and all at the same moment. Working like this makes our minds formidably powerful information crunchers. We are easily able to perform mental work on a multitude of different aspects of a single item, or even separate items simultaneously (walking and chewing gum, for example.)

So, if our mind really is a massive battery of pattern associator networks, of which large numbers can be simultaneously active, we have the basic architecture for *"associative learning, in which we learn to produce a particular pattern of activation on one set of units whenever another particular pattern occurs on another set of units."* (Rumelhart & McClelland 1986, p.54)

The point to which this argument is working is that, if associative learning is true, and if processing really is parallel and distributed, if quantities of stuff can be variously managed in different sites at the same time, there is the possibility that we learn everything simply in terms of associated patterns and very easily learn very large numbers of such associations, and patterns of associations. After a little bit of pattern learning the mind will begin to behave in a "rule-bound" way, to behave as if it knew, and consulted, rules before acting. This is, as you can see in the scenario here drawn, an illusion as *there are no rules in there* at all! Learning is possibly simply the arrangement of connections between cells into pattern associator nets. This *"... allows a network of simple units to act* as though *it knew the rules."* (Rumelhart & McClelland 1986, p.32, their emphasis.)

So here we all are, perhaps — a colossal collection of pattern associators in a vast interconnected network. Everything we have

learned has been built into the circuitry as we learned it, without the need for a single rule to be specified. In fact, it is much simpler and more robust for not having any rules to which the associators need refer. It is also more flexible, much better able to cope with a new idea than a rule-based system would be. It can readily assign a likely meaning even to imperfect inputs. This is a stunning, shocking notion which, once you are used to it, is profoundly elegant, even voluptuous. We operate with so many pattern associators that we produce behaviour apparently meticulously controlled by rules, with absolutely no knowledge of any such thing. Nowhere in the system need any spelling laws be described in order for us to produce excellent spelling! Since pattern associators are able to do their associating even when input is imperfect, we can even spell, and read, new letter arrangements without difficulty or the need to revise any previously learned "rules"...

And, of course, it turns out that we all "knew" this anyway. We all, for example, produce language of complexity and grace and acknowledge that we do this with not the slightest knowledge of any of the "rules" of grammar or syntax! We are all, more or less dimly, aware that grammar is complicated and ramifies into the distance almost as far as the eye can see. Thus it is also with spelling "rules". We are, initially, shocked by the idea that we might not "know" any rules at all but, perhaps, knowing how byzantine and exception-ridden English spelling rules are, we ought to have been more astonished at the idea that we could learn, and so easily apply, a system so baroque in its complexities. Is that idea any less outrageous than the idea that we learn by simply wiring up little pattern associator circuits (albeit in large numbers!) completely innocent of rules? (And, after all, so many other physiological systems which seem at first so unbelievably complicated turn out to be "only" an absolutely enormous number of simple things adding up to a single very complex one.) And pattern associators have one enormous advantage — they do their work in our subconscious. We do not have consciously to "think" in order to operate them. Indeed, perhaps the more we try to think about them, to influence them, the less well they perform.

The centipede was happy, quite,
Until the toad, in fun,
Said, "Pray, which leg goes after which?"
This worked his mind to such a pitch
He lay, distracted, in a ditch
Considering how to run. (Watts 1957, p.47)

While learned pattern association goes on in the unfathomable and practically unlimited unconscious, thinking about rules has to take place in the hectic and very limited conscious. If there is the slightest chance of getting the subconscious to look after any process for us, we should gratefully seize it! (This is, of course, precisely what practice achieves.) To learn a "rule" before the patterns to which it will apparently apply have been "overlearned", *simply as patterns*, to subconscious standard, is to risk the patterns forever thereafter having to be referred up to conscious thought for decision and execution whenever they occur. A student who is taught to learn spelling rules before patterns has their capacity "just to write" spiked, in fact.

This is the principle on which the best conversational language courses now function and we should take a leaf from their book. Modern "conversational language" courses deliver grammatical fluency astonishingly quickly and securely. They do this, paradoxically, by eschewing any teaching of, indeed any mention of, grammar *per se*. Grammar is introduced stepwise and logically, but covertly. Typically, a session will be built around a single grammatical reality (a particular tense, for example) and the ostensible targets of tuition — vocabulary, idiom, intonation, etc. — presented and practised within the setting of that grammatical reality. Students learn, very rapidly and very dependably, how the particular grammatical construction they didn't realise they were learning "feels" or "tastes" in the new language. Job done, at this point. Such internalised learning "makes sense" — it will stick. It will also, of course, remain painlessly, yet absolutely reliably, in the subconscious.

The student, in other words, has been allowed to learn in his or her own mysterious way, presumably in the same way we all learned the grammar of our own native tongue as tiny infants. How we all achieved this is still something of an enigma. The idea that we learned complicated, convoluted rules (which none of the adults about us were able to enunciate!) is only one hypothesis, and a wobbly one at that. However we managed it, we can assume that it was by the most

effective and economical method. I find it arrogant, in our present state of ignorance, to try to impose any single learning method on the mind. Intuition tells us that seeking and learning "rules" is "learning about language rather than learning language". Intuition is, surely, often right.

To indulge in a little fantasy: it is as if in my mind all those years ago, while I was learning almost every English spelling pattern just as such, without any "rule", just practising it until established at subconscious level, one pattern (i before e...) was permanently mentally flagged with a special instruction, which reads:

> STOP! This spelling is difficult!
>
> CEASE WRITING! Do not proceed until back-up procedure *IE/C (b)* has been carried out!
>
> REDIRECT ATTENTION! Consult circuits *IE/C/442 IE/C/445* [conscious spelling systems; section "i/e"; subsection "associated c"] before continuing writing procedure!"

No. If it is not necessary to write convoluted and inherently unmemorable rules, with their associated plethora of exceptions, into the system, if the system can most simply and directly function subconsciously without rules being specified anywhere, don't let us force people to learn them. Don't let us give the impression that that is how the learning of spelling is to be attacked. Sensible, motivating material and good practice are all that is required. Let us keep silent on the subject of "spelling rules" which, after all, we know next to nothing about anyway. Let us leave the mind free to learn the patterns in its environment in its own, still inscrutable, way.

Chapter Eight

Writing

Most skills, it seems to me, are learned by students rather than taught by teachers. Good teaching is, as they say, "merely" the provision of an environment in which learning will take place. This applies particularly to writing. Good writing is an absolutely non-derivative expression of thought. Good writing is autonomous, personal, individual. The aim of tuition should be good writing. This may entail not much more than setting out in pursuit of the right objectives. These include personal autonomy and the confident, free ownership of language; the confidence to try, and the skills of surviving and profiting from failure; how to consider, criticise and correct writing; the positive and properly enthusiastic use of a waste paper basket, and so on.

The skills in good writing range from the meta to the micro, from the assembly of wise, worldly and witty thoughts to the careful consideration of commas. It is, of course, perfectly impossible to teach all this as a "subject". It is impossible to learn writing without doing it, without working on some actual stuff, ideally, your own stuff. Back we come to "language experience" used with a method I shall call the "exploded text" method.

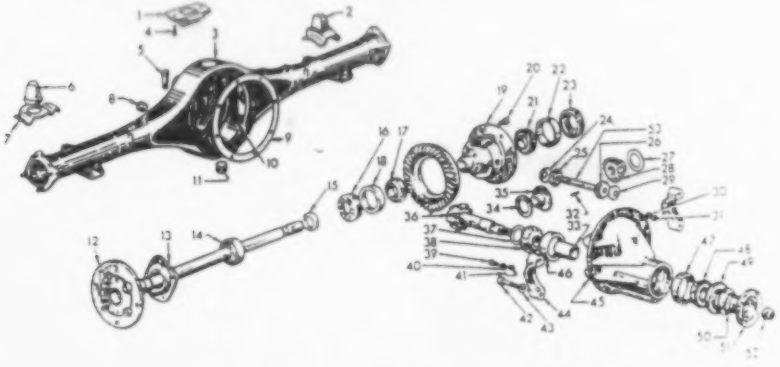


Figure 8.1 Rear axle: component parts

Figure 8.1 is what an engineer would call an "exploded view" of a mechanism. All the bits are, in imagination, blown apart and then drawn. The viewer can, as a result, see very easily where each bit goes, what relationships it has with other bits, and therefore what it does — in short, where it fits in the greater scheme of things. What is sauce for the engineer may be sauce, also, for the educator. If a piece of writing is "exploded" all the detail and all the relationships will become much more visible.

A piece of text is "exploded" between full stops. Ideally every "sentence" is physically separated (e.g. the text is actually cut up and photocopied, or retyped with line spaces between full stops) or at least every full stop is greatly exaggerated. Somehow, at any rate, each "sentence" is made very independently visible, very easy to consider in isolation. Each "sentence" may then be read out aloud as many times as is necessary to answer questions asked of it, such as:

- Does it make sense?
- Does it "read well", sound nice?
- Is it really a sentence?
- If not, should it be broken up, changed, or amalgamated? Does it say what is intended?
- Does it fit with the rest of the piece? Should any fat be cut from it?
- Do the spellings look "right"?
- Does the punctuation fit the way it "reads"?
- And so on, and so on.

Here is an example:

- "I think the worst time was when I went for job interviews.
- The manager or who ever toke the interview would arsk me to feel in a application form I would seet there and wish I had dune will at school.
- In the end I had to arsk the person tacking the interview to fill the form out for me.
- So you cam emagen how he would fill about employing me.
- I felt os embarrassed.

- I think most off them must have felt sorry for me as I still got most of the jobs I went for but one which was the London fire serves.
- I got threw all the medical exams and things like that untill it came to the writen exam which I did not do as new I would fail it.
- I got so mad with my self for not being able to fill the form in.
- I could off had a good job for life."

Figure 8.2 A student's writing "exploded"

It is far easier to see, and deal with, writing in sentence-sized chunks. All sorts of things are learned by looking at it this way: the skill of organising thought; the skill of critical reading; the skills of sentence recognition and construction; punctuation skills; visual checking of spelling and, probably most important of all, the ability to examine writing in an autonomous and constructive way. (The myth, incidentally, of the "good writer", who always gets everything right first time, will also have to be thoroughly dispelled!)

The point is assuredly *not* to cause the student to write as the tutor does, but to enable clear expression of the student's own "voice". The point is to reveal to the student how he or she can produce better, more "worked", more intentional, directed and accurate writing containing more of what they want and less of what they don't. A student, after all, should leave tuition independent, confident and free; self-sufficient not merely at the level attained in "class" but able, motivated and theoretically well-informed enough to develop further, alone and autonomously; to provide their own learning environment; in short, to ripen into their own, lifelong teacher.

Chapter One Notes

The "Dyslexia Thing"

"Dyslexia" is a very much bandied, misused and over-used term. Any book on literacy must at least touch a tentative toe into the swirling politico-scientific controversy surrounding dyslexia, so here we go.

Some people say that dyslexia is a real thing, some say it isn't, and some say that it is mainly a political thing, a social construct. (*"A middle-class child with reading problems is dyslexic. A working-class child with reading problems is a lazy little sod." The Guardian*, headline 25th March, 1986.) What, if anything, are we to make of it or do about it?

One definition of dyslexia widely accepted is that of the World Federation of Neurology:

> *"A disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity. It is dependent on fundamental cognitive disabilities which are frequently of constitutional origin."*

In other words, dyslexia is a difficulty with reading which may only be diagnosed if there are no other obvious causes to hand (such as poor schooling, poor parenting, low IQ or social disadvantage). It is caused by there being something wrong within the brain (well, very often, anyway).

Not much to get a grip on there, perhaps!

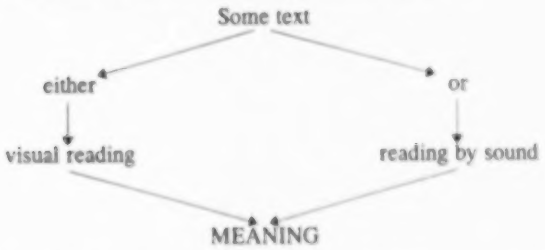
Dyslexia, if we are to be absolutely accurate, is nothing to do with spelling. Dyslexia is a reading problem. The poor spelling problem is properly called Dysgraphia, in fact. However, we don't want to get so far in as to be unable to get out again, and dyslexia is the word everyone uses for both reading and spelling difficulties. I shall adopt the same bad habit here at times, for the purposes of argument.

"I suffer from a mild form of dyslexia" someone is likely to say, having misspelled something, or "John is a little dyslexic", should John do the same. Let us dissect this idea.

Dyslexia is described as either *acquired* or *developmental*. Remember that dyslexia means a *brain dysfunction* causing a reading

disability (though commonly used to mean ditto re spelling ability as we noted above). The brain dysfunction may be suddenly acquired, as a result of trauma to the brain (a stroke, for example). This is *acquired dyslexia*. The other form of dyslexia is held to be caused by a brain dysfunction, a "neurological deficit", present from birth or before. This is *developmental dyslexia*.

Acquired dyslexia is horribly real. There are only too many patients who have had their reading ability suddenly damaged, and their symptoms have been exhaustively correlated and catalogued. Acquired dyslexia "makes sense" in terms of cognitive psychology. If that part of the brain which had learned the skills of reading is suddenly damaged, of course the patient will suddenly develop a reading disability, a dyslexia. The extent of the dyslexia will depend on the exact site and extent of damage within the brain. Psychologists consider there are many different kinds of dyslexia, depending on which areas or pathways are damaged. We can content ourselves here with discussing just the two broadest categories of acquired dyslexia, *"surface dyslexia"* and *"phonological dyslexia"*. (In reality, of course, seldom found in "pure" form.) In order to discuss these dyslexias we must have a simplified map of reading pathways to hand.



As we have seen before, we read from text to meaning by sight normally, but can, should the need arise, read to meaning by the sounds of language. *Both* routes are normally available and either can be used. Anatomically, of course, the wiring of the two routes is in different parts of the brain. (See Figure 1.2) Trauma may therefore damage one route without affecting the other.

Patients who have had the visual reading pathways damaged can, thereafter, only read by sound. They suffer *surface dyslexia*. Such patients can easily read very familiar words, phonically regular words

and phonically regular non-words. They have tremendous difficulty with unfamiliar words which are not phonically regular. They easily read "hee woz verri kene onn hur wuns" but read "island" as "iz land" for example. Their problem is that they have to read the sounds of text, and have only familiarity or the "rules" of phonics to go on.

Patients, on the other hand, who have had the phonological reading route damaged can, thereafter, only read by sight. They suffer *phonological dyslexia*. Such patients easily read familiar, known words, however phonically irregular, but are thrown by new or nonwords. A phonological dyslexic would be flummoxed by "Orl thay sed woz itt duzn't wurk az itt shood!". "Deep" dyslexia, a profound phonological dyslexia, results in patients who may read "ape" as "monkey", "house" as "building", for example. The patient has read a familiar word to meaning and accessed an adjacent meaning, good enough for the purpose, probably, but totally unrelated by sound to the original.

So much for acquired dyslexia. The other dyslexia is *developmental dyslexia*. But *is developmental dyslexia real?* This is a whole lot more difficult to answer and, in my opinion, the jury is still out. The prevailing psychological opinion, a few years past, was that such a syndrome did exist and was caused by a neurological deficit, something wrong with the brain. Nowadays, writers on literacy tend to enthusiastically doubt its very existence, but then go on to talk about it in great depth! There are certainly children who have reading problems and sometimes these are bizarre and extreme (the reading problems, I mean). Several famous names have widely publicised their "illness". There is, clearly, a real enough problem; what is still unclear is the reason, or reasons, for it.

To accept developmental dyslexia as a syndrome caused by a deficit in the brain, present from extreme youth, before reading is even attempted, you have to postulate that a part of the brain is earmarked for, evolved specifically for, reading. You must then postulate that this part of the brain is, in some way, inadequately structured. You must then further postulate that at the time when reading is to be learned the young brain is not flexible enough simply to use another bit of its extremely extensive, partly superfluous capacity. (This, we know, is unlikely. Children with quite extensive brain damage, if it happens early enough, just use what remains of the brain to learn with and can grow up quite normal, *including* the ability

to read and write.) In other words, it is difficult to see how a child could grow up to have a *neurological* reason for reading difficulty without being obviously defective in many other higher mental capacities as well.

In the classic examination of the problem to date, Rutter and Yule (1974) looked at "Specific Reading Retardation" (defined as a twenty-eight month or more gap between reading ability and IQ at age ten). They found that three point five percent of the children studied were thus retarded on the Isle of Wight, but six percent in Inner London. There was manifestly a reading problem of some magnitude. Could they find a single cause? They went on to look at all the suggested neurological and inherited signs (clumsiness, poor co-ordination, left/right confusions, late talking, a family history of reading problems, Uncle Tom Cobbley and all) and failed to find good repeatable correlations. (They did, though, find that boys were three times as likely as girls to fail in this way and that there was a social class variation, as always.)

I don't know. I leave you with four anecdotes.

1. I knew a man with a stammer so oppressive that it was difficult to converse with him. He seldom managed a single sentence without a spasm of stammering — under normal circumstances, that is. He was a leading light in the active and high quality local dramatic society, however, a very talented actor and comic, who took the leading role in most productions. On stage he breezed through the drama without a trace of stammer, with fluent flair, with never a hitch — and then became stammerbound as soon as he left the theatre.

2. I knew a university undergraduate with a *bona fide*, expert diagnosis of severe dyslexia in her handbag. She wore plain, tinted-glass, "spectacles". These spectacles were not lenses at all, just plain glass, tinted a very pale yellow. She claimed, she genuinely believed, that she had reading difficulties so severe that she was not able to read her university texts without these "spectacles". She also claimed (and this was demonstrably so) that she was perfectly able to read, she could read normally, when looking at the text through tinted glass. She further claimed, moreover, that the actual colour of the glass made no difference to the effect they had on reading ability. She had

successfully used red and blue glass. She finally chose yellow simply because she liked yellow.

3. I taught a student once who arrived with a four-page diagnosis of "moderate to severe dyslexia" from an internationally-recognised expert. Initially, of course, I was scared out of my socks. However, I decided that all I could do was the same as with any other student so set off as usual. In the event, I found no difference between this and any other student. He went on, after a fairly short period of literacy tuition (with somewhat eccentric spelling it must be admitted!), to university and a degree. Significantly, this student frequently used to say how "different" ABE "classes" were to school.

4. I met a lady once who was apparently unable to write her cheque while I, a comparative stranger, was opposite her. She eventually asked me to leave the room and then, in no time at all, wrote, fluently and correctly, what she had been totally unable to write a moment before.

All these people were able to perform in certain circumstances, but not in others. They all had, in other words, *no neurological deficit*. There was nothing wrong with their brains, no "cognitive deficit" at all. Given one particular context rather than another, they performed perfectly adequately. Had they each found a psychological placebo which enabled them, under certain conditions, to circumvent what was actually a socially induced handicap?

Our two brains

The management of language in each of our two brains has been much investigated using "split-brain" patients who have had their corpus callosum severed (as a treatment for severe epilepsy), thereby isolating the two brains from each other. Even in these patients, experience seems, subjectively, very much as before. (Though they do report being less good, for example, at remembering the names of people they don't know all that well, even though perfectly able to recognise them by sight.) All of the environment is experienced by both brains all the time, normally. As usual, sound entering the left ear is "heard" almost entirely in the right brain as usual, and that from the right ear in the left brain, but since both ears are usually hearing

the same thing at the same time there is no problem. (This crossing-over of fibres, incidentally, occurs in brainstem, not corpus callosum.) In the split-brain patient we can, however, arrange things such that we can communicate with either one or the other brain alone.

Most nerve pathways from brain to other organs and parts of the body cross over, at brainstem level. The right side of the body, for example, is experienced and controlled by the left brain, and vice versa. We have just seen that the same applies to our hearing. The optic nerves, running from the eyes, cross over in the same sort of way. All the nerve fibres from one side of the retina, in both eyes, run to the same side brain. In other words an image on the right side of the retina (in front left of the eye) is "seen" in the right brain, an image on the left of the retina (in front right of the eye) is "seen" in the left brain. As we look ahead, our left brain sees what is to our right and our right brain what is to our left. Of course, in a normal mind all the information is instantaneously shared between the two brains (via the corpus callosum), but in a split-brain patient it is not.

Now look at the figure on the next page. It is a figure which has been used in experiments with split-brain patients.

(Spring and Deutsch, 1981)

Imagine a split-brain patient sitting facing a screen in the semi-dark. A white dot is seen bang in the middle of the screen and the patient is asked to look fixedly at it. Suddenly, and for less than a second, the figure above is flashed onto the screen, in the exact middle of it, so that the patient is looking at a point halfway down on the line between the two halves of the picture. His right brain will "see" half an eye (and will think it has seen an eye), his left brain will "see" half a bee (and imagine it has seen a bee). Ask the patient to *say* what he saw. He will tell you he saw a bee. Show him some drawings, including the eye and the bee, and ask him to *point* to what he saw. He will point to the eye. His left brain can verbalise the bee, his right brain can point to the eye. Asked to verbalise, his left brain responds "a bee"; asked to point, his right responds "an eye"!

Chapter Two Notes

Evidence for visual reading

Various experimental evidence exists to demonstrate that reading, indeed all literacy, is primarily a visual activity and that phonics is neither necessarily nor usually involved in it.

Acquired phonological dyslexia is a condition, sometimes induced by a "stroke", in which that part of the brain responsible for grapheme/phoneme or phoneme/grapheme conversion (see Appendix 1) is damaged. A patient thus afflicted is unable to process written language into sound. Reading silently to meaning is, however, relatively unaffected — so long as only words already known to the patient are presented. Thus, the patient may be able to read "familiarity breeds contempt" but unable to read "phamiliariti bredes kontemt". The patient is able, in other words, to access meaning directly, visually, but not to achieve meaning from print by phonic analysis.

"Priming" experiments. These are commonly used in cognitive psychology to explore the management of language in the mind. The basic priming experiment is simple; subjects are shown a "priming" word (or string of letters), typically on a computer VDU screen, for about a second. This "prime" disappears, to be replaced by a "target" word or string of letters. A decision is required about this target, for example as to whether it is a real word or not. The decision is indicated by the subject pressing one of two keys marked on the computer keyboard. A subject may see some fifty to a hundred prime-target pairs. Many subjects will be asked to carry out the procedure. The computer measures the time taken to respond to each target. A short response time is taken to mean that that particular task was, for some reason, easier than one with a longer response time. One experiment, to give an example, found that response was quicker to a target word "chips" if the prime had been "fish", or "Concerto" if the prime had been "violin". (This probably demonstrated that priming with one word "activates" all related words, making them easier to retrieve and make a decision about.)

Morton (1979) (cited in Ellis 1984) used priming to explore the independence from each other of possible auditory and visual access

systems to the semantic system (see Appendix 1) as follows: Subjects heard some priming words spoken but were asked to read others. They also heard some target words spoken and were asked to read others. Morton found that when prime and target were either both auditorily presented or *both* visually presented, reaction time was less than when auditory prime presentation was followed by visual target presentation or vice versa. He concluded that visual and auditory systems accessing the semantic system do indeed function independently and must be separate.

Gibson (cited in Ellis 1984) found that priming with visually presented and conventionally spelled words (e.g. fox, yacht) did not prime their recognition when subsequently presented as spoken targets, but that if the prime words were visually presented but spelled phonetically (e.g. focks, yott) then subsequent auditory presentation was primed. Gibson concluded that the reader in case one was not activating an entry in the auditory lexicon (because he was reading to meaning purely visually), but that in case two the reader was activating auditory lexical entries through grapheme/phoneme conversion (see Appendix 1) in order to reach meaning. In other words, his subjects, under normal circumstances, were reading purely visually and only called phonics into play when visual reading failed. Normal reading did not involve phonic analysis.

Murrel and Morton (1974) investigated the role of morphemes in language management. (A morpheme is the smallest meaningful unit of a language. For example "unnecessary" contains two morphemes, "language" only one and un/tidy/ness three.) Murrel and Morton primed subjects with words like "see" and "car", and then presented target words including "seen" and "seed, "cars" and "card". They found that where the root morpheme was the same in prime and target (e.g. see and seen, car and cars) priming did occur, whereas when the root morpheme was different (e.g. see and seed, car and card) it did not. This was in spite of very closely related sound patterns, and Murrel and Morton concluded that: "The process of recognising a word involves assigning it to a linguistic unit with specific semantic associations, i.e. a morpheme". There was no evidence that recognition was made any easier by "visual-acoustic similarity".

Chapter Three Notes

Who, or why, am "I"? (and does it matter?)

This may be the moment to introduce consideration of The Big Question. Some intuitive disciplines — Buddhism is an outstanding example — have recognised and addressed it, at least at a practical level. It amounts to a fundamental paradox and, in true paradoxical fashion, can perhaps best — maybe only — be overcome through acceptance. It is, of course, the enigma of "consciousness": the extraordinarily difficult concept of "self". What is consciousness? What is it for? Who, or why, am "I"?

At first glance, it seems absolutely self-evident that "I" am in complete control, if not of my feelings, at least of my thoughts and actions. This "I" who is so in control is, naturally, my conscious, aware "self". It seems absurd to question the belief I have lived with so long, and for which I seem to have such unanswerable evidence, that "I" think, weigh up pros and cons, make decisions, and take actions. It would appear to be irrefutable that "I", an aware being, see, hear, direct "my" attention, summon up ideas and the language to dress them in, and all the other things "I" do. However, the discomfiting probability is that this is only an illusion. What, exactly, consciousness is — indeed why, exactly, consciousness is — is the ultimate puzzle. I am going to allocate but a little space to this problem on the grounds that more than a very little will make both of us giddy.

You think that you are reading this book with your conscious mind. It certainly feels as though I am writing it with mine. However, both logic and experiment easily show that we are both mistaken. We can agree, by now, that we do have a conscious which is only rather moderately clever, but which is aware. We can also agree that we do have an unconscious which is inordinately clever, but unaware. We can further agree that the conscious can only deal with a small number of items at a time, whereas the unconscious routinely deals with unimaginably large quantities of items in incredible detail. We have to accept that our conscious only functions with rather complete, refined, well-defined concepts while our unconscious digests and correlates an avalanche of details which are almost completely meaningless in

themselves. The unconscious, we know, does the information-crunching computing necessary for the recognition, or rescuing, of concepts from the unruly mass of raw information of which "reality" is inevitably composed.

Vision will do very well as an example. Millions of bits of visual information pour into my brain along my optic nerves. A mass of details of light and dark, intensities and colours, shapes, edges and surfaces, curves, and corners. There is light and shadow, greys, browns, greens, yellows, and blues. My long suffering mind unconsciously sorts all these out, sifts, correlates, and interprets them. After unbelievably complicated computing, it is able to tell my conscious mind that I am looking at a bluetit half hidden inside a privet hedge outside my window here. A complexity of detail has been reduced to a simplicity of concept.

We are obliged to admit that "I" — my conscious self — could never have even taken in, never mind digested, this plethora of information which is yet managed so routinely by my unconscious. (There is simply no way in which the conscious could direct all that detailed electric circuitry it knows, after all, nothing about!) We are driven to accept that "I" would be utterly unable to function without "my" enormous unconscious digesting, analysing and representing reality for me. It follows, I am sorry to say, that what my conscious mind is experiencing is simply an invention of my unconscious. Not only that but, since all the processing my subconscious does must take some time, what "I" experience at any moment must already have been experienced by my unconscious. Whatever "I" think is going on, whatever "I" believe "I" am doing, thinking or experiencing, was done, thought or experienced some time ago in my unconscious.

Logic has opened up the probability that it is the unconscious which manages all mental activity. For some reason, however, a tiny part of all this activity, after digestion to concept level, is "made manifest" for a consciousness to chew on. Someone who is "aware" is given, by someone who is not, part of the end-product of mental activity. The conscious begins to look a little redundant, not to say preposterous. "I" am starting to look irrelevant to "me" as "I" play around self-importantly with ideas which have already been dealt with, by "me", in "my" unconsciousness.

Logic has suggested a time lag between what goes on in the unconscious and the echo of a bit of it in the conscious. Has anyone

tried to measure this gap and, if so, how long is it? Has the time between the arrival of information or the first stirrings toward action or decision within the unconscious, and the conscious awareness that "I" have experienced or decided something, been quantified?

Benjamin Libet (among others) has researched the conscious over many years. One set of experiments will do as a nice example of the kind of thing he got up to in the late sixties and early seventies in America. He was exploring what went on in the conscious and unconscious minds of people when they made a very simple decision to move a finger. I will describe a procedure he used to compare electrical activity in the brain with subjects' conscious experiences. (Nørretranders 1991)

A subject is asked to get comfortable in an easy chair. The subject is facing a "Wundt's clock". This device displays a disc travelling round a circular clock face every couple of seconds. This clock is a commonly-used device for accurately pinpointing events in time. The subject is asked to look at the clock and, whenever it suits him (or her) to decide to move a finger of the right hand, and to do so. By telling the experimenter exactly where the disc was on the clock face when he (or she) made the decision to move the finger, the exact time at which the conscious thinks the decision was made can be pinpointed.

Attached to the subject while this is going on are the electrodes of an electro-encephalogram, or EEG. An EEG is a device for picking up, and recording, electrical activity in the brain. We are, thereby, able to detect any new, or unusual, activity in the brain — conscious or unconscious. For this experiment an electrode was placed over the "motor" area of the left brain. This area generates instructions for movement of muscles on the right-hand side of the body. All such activity will be recorded on the electrode.

A comparison of brain activity and timing of the conscious decision to move the finger showed that brain activity in connection with the moving of the finger was detected almost half a second before the conscious decision to move it! The EEG clearly showed new and rising activity in the left motor area associated with every episode of finger movement. This consistently happened almost half a second before the subjects were making the conscious decision to move. In other words the unconscious began setting the process of assembling and issuing instructions appropriate to finger movement in motion well

before the conscious knew anything was afoot. It is as if the unconscious managed the whole event and, almost as an afterthought, informed the conscious, which was fooled into the belief that it had itself made the big decisions.

We are on the slippery slopes of philosophy now. We must stay calm and come down carefully. Everything in my conscious has already been managed to completion in my unconscious. (Whatever is in my conscious is, anyway, only whatever my unconscious has put together from the available data. It could be lies.) "Reality", or my awareness of it, is an illusion. It is history. It happened (and was successfully managed) a little under half a second ago in my unconscious. Why, you might well ask, does the unconscious take the trouble to tell "me" about any of it? Why do "I" need a consciousness at all? Is it all a mistake? Who is this "I", and why?

All of the above is, perhaps, (but only perhaps) irrelevant. I believe many tutors will, all the same, recall many instances when the main obstacle to learning appears to be the student him or herself — the student's consciousness, that is. Consciousness often, it seems to me, interferes with learning. It does this in several ways: sometimes it is "too clever" and insists on trying to find, and learn, "rules", or thinks at an inappropriate level (too "high", usually). (Does learning actually happen as a result of conscious thinking at all?) Sometimes the "self" interferes with learning by bringing up ancient emotions, doubts as to abilities, speculations as to the likelihood of failure, consequences of same and so on. Sometimes the conscious takes the whole shebang away out of the window, to where, in the real world, Mrs Williams has just backed into John Evans' new car...

I think many tutors will recognise the feeling of trying to "get in behind" the student. Trying to get them to learn something without "knowing" they are doing so — without invoking conscious thought. Almost fooling their student into learning! A student might, for example, be presented with an exercise to practise a particular spelling pattern. While this pattern is ostensibly the target of the exercise, another, new pattern is also being introduced. Nothing is said about the new pattern. It is simply learned. It is often the better learned for being covertly introduced than it would have been if drawn to the student's attention (that is, made known not only to the student's unconscious but also to his or her conscious). It is often obvious that if the student had "known" what was afoot, learning would have been

more difficult and less secure. The conscious, here, is being induced to look away while something is secretly sneaked past, by implication directly into the unconscious. Perhaps direct appeal to the unconscious, leaving the conscious in the dark, leads to more rapid, reliable, and robust learning? We admit that all the stuff we ever do learn is, somehow, organised, stored, and managed in the unconscious. Maybe the unconscious should be allowed, as far as possible, to do its filing and cross-referencing in its own, still mysterious way? Is it not presumptuous to assume we could, consciously, do any better?

Chapter Four Notes

Evidence for visual spelling

Evidence that there are two major routes to writing from meaning, and that we commonly use the direct, purely graphemic, non-phonic route, comes from the study of Dysgraphia. (While dyslexia is difficulty with reading, dysgraphia is difficulty with spelling.) You will find reading about dyslexia or dysgraphia easier if you look at Appendix 1 while doing so.

Surface dysgraphia is a condition in which access to the graphemically coded visual output lexicon from meaning is obliterated. (This may happen as a result of a stroke.) Patients with surface dysgraphia can no longer find spellings directly. They can only do so indirectly, around the phoneme-grapheme conversion link route. Such patients do their spellings entirely by sound, even when writing words whose spelling they used to know well, producing examples such as "neffue" (nephew) and "bisket" (biscuit).

Phonological dysgraphia is the reverse condition. A patient with phonological dysgraphia has sustained damage to the phoneme-grapheme conversion link. Such a patient will be able to spell words whose spellings are already known. He, or she, will, however, be poor at assembling candidate spellings for new or non-words, since this would normally have to be done either by visual analogy with known words or, more likely, through the sounds of the word.

Spelling Reform

People go on suggesting that the English spelling system should undergo "reform". "Reform" usually means making it "phonically regular". (The "i.t.a." reform, is one such example) There are many arguments against such phonic reform, however.

What would we do about regional differences? If the thing is to be phonically regular then a Liverpudlian will have to use a drastically different system to the Prince of Wales, and both of them use a different system to an Aberdonian, or me. Children might have to use a different system to their teacher. If it is to be one system nation-wide, why should it be yours and not mine?

Semantic clues will largely disappear. Units of similar meaning which sound different will be spelled differently. No and nollij, nativ and nashunal will no longer obviously have any relationship. Wee wood hav to rite notist, hawdid and plased; hawsiz, rodez, and botes. Will this be any easier to read? If not, will spelling be rendered sufficiently more accessible to compensate? Many people, Chomsky among them, consider that English spelling has evolved in such a way that readers are enabled to home in on just those meaning-bearing parts of a text which really matter. Should this facility disappear a reader would be obliged to examine all of every word, something we probably don't presently do.

When we read, we probably use a cascading, minimal cue, visual feature analysis system (see Chapter One). If these features were removed and replaced with one-dimensional (sound) featured spellings, reading would be slower and more difficult. So would comprehension.

The most compelling argument against reforming English spelling towards a phonically mediated system is simply that we don't read or spell phonically in the first place. We just don't use phonics, except when the visual system fails altogether or is inappropriate at the particular instant (e.g. when encountering a strange new word) either when reading or when spelling. We would gain nothing, except at the very, very beginning of the process of learning to spell, and would lose much assistance with the reading process. (We could usefully remember here that, for most of us, writing is a much less frequent activity than reading.)

> *"It is worth noting a healthy trend towards trying to understand our orthographic system, instead of trying to reform it."*
> (Brazil 1982, cited in Peters 1985 p. 35)

Chapter Five Notes

Signal Detection Theory *(see Smith 1988, esp. pp. 58-60 245-246)*

Signal detection theory provides a fascinating insight into how we decide whether, or what, to see *on the basis of attitude, on criteria in our heads*! Whether something is seen or not can depend, in many circumstances on the observer, on criteria his or her mind is using, even on his or her state of mind at the time. This seems ridiculous, but please read on...

The theory has, actually, nothing to do with literacy. It was a theoretical analysis of radar operators' performance during the Second World War, as they screened the skies for enemy aircraft. It gives us a very powerful insight, however, into early reading, the need for confidence, and for as rapid an acquisition of the skill as possible.

A radar operator, faced with a fluorescent screen showing a whole lot of fuzz and maybe a clearer "blip", has to make a decision. Is the blip a real plane (which must be brought down) or just screen "noise"? He can make only one decision — either it is, or it isn't, a plane. He can make two kinds of error: a *false alarm* (deciding "noise" was a plane) or a *miss* (deciding a real plane was "noise").

The operator's behaviour, what he decides, is affected by the *criterion* he uses. If ammunition is very short he will use a tight criterion and opt to see only really clear blips as planes. He will hit fewer planes, but he will also have fewer false alarms and more misses. If ammunition is in very good supply he will use a much looser criterion and opt to see even pretty fuzzy blips as planes. He will, of course, hit more planes, but he will also have more false alarms and fewer misses.

What we have to notice is that, for any given operator using a given machine, the rates are all inextricably bound together. If the number of hits is high, then the rate of false alarms is also high; and if the number of hits is low, then so is the rate of false alarms. (The rate of misses is inversely, but also, likewise inevitably, linked.) *These relationships are inevitable*. The only way they could be different is if the operator alters in some way, or uses different equipment. We can plot a graph of operator performance. This is known as an "ROC"

curve, a "Receiver Operating Characteristic" curve. (You know how mathematicians talk!) One is drawn in Figure 5.1.

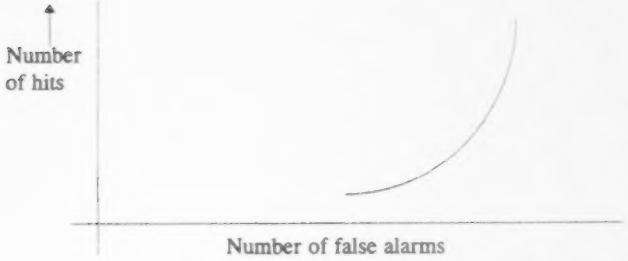


Figure 5.1 ROC curve (not-very-good operator!)

Please note, again, that the operator can only "move up or down" on this curve, the curve's position and shape being dictated by his skill and the standard of his equipment. To achieve more hits (move up the curve) he has to accept more false alarms, and, of course, vice versa. Should he improve, get better at the job, or should better equipment be issued, the whole line will shift to the left. He will then score more hits for fewer false alarms, but he will still be trapped on a curve, his new one. He will still be able to move up, or down, only along the curve. His new curve, though an improvement, *is still absolutely binding*. (See Figure 5.2)

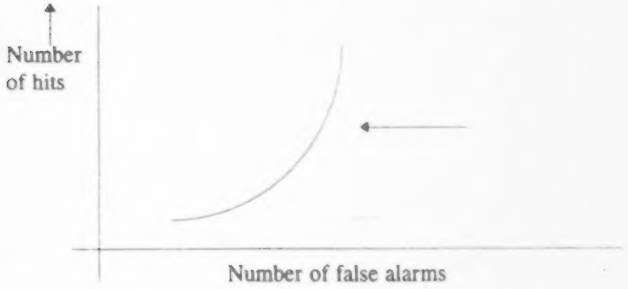


Figure 5.2 ROC curve. Operator improvement

What use is any of this in literacy?

The point, the *only* point, of reading is the gathering of meaning from the page. If you want to keep in touch with meaning the fact is that you have to read above a certain speed — actually around two hundred words per minute. You have to keep the speed up or you begin to lose the meaning. If you don't believe me, try reading the next sentence at about one word a second.

When -O- reading -O- aloud -O- there -O- is -O- an -O- "eye -O- voice -O- span" -O- of -O- several -O- words -O- and -O- if -O- the -O- text -O- is -O- suddenly -O- obliterated -O- (if -O- for -O- example -O- the -O- lights -O- all -O- go -O- out) -O- the -O- reader -O- is -O- able -O- to -O- complete -O- at -O- least -O- the -O- current -O- clause, -O- possibly -O- even -O- the -O- remainder -O- of -O- the -O- sentence -O- without -O- benefit -O- of -O- the -O- text -O- at -O- all.

Using the ROC curve graph in Figure 5.2 and the analogy of a hit as a word read correctly and a false alarm as a word misread: a reader, just like an operator, can only move up or down his or her curve. If a decent hit rate is to be achieved, then the reader has to accept a certain rate of false alarms. *If he or she is to achieve a decent rate of correctly read words, he or she must operate high up on the curve, must accept the risk of misreading*. And the reader, just like the operator, can decide to do this. *The criterion in the mind is set by the student*. If, through anxiety, or worse, because a tutor insists on the paramount importance of getting every word right, of making no errors, the student operates low on the curve, then a low rate of hits inevitably results. Confidence, and the freedom to make mistakes, is what will slide the student up the curve.

It is, in other words, essential that the right kind of criterion is chosen by, and for, the student. Paralyse a student with the fear of error and the student slides down the curve where slow reading eradicates all meaning, depressing confidence, and causing further slide, further down the curve...

The only improvement that can be made involves, as we have seen, shifting the curve itself. (Smith says we "learn to read by reading"!) This means either a clearer signal (a more accurately assessed level of text) or an improvement in reading ability. A student must be kept high on the curve, by keeping confidence high. Tutors must avoid training a student to a rigid, anxious tactic of insisting on

reading every word correctly at all costs, must avoid giving the impression that that is what reading is. Meaning is the goal of reading and confident speed is the essence of it. (See Chapter Six for some discussion of specific methods.)

Chapter Six Notes

Assessing "readability" of texts

If you want to use a text, other than one produced by a student, for reading practice (paired reading, perhaps — read-along probably) you are likely to want some idea of whether the text is a difficult or an easy read. (It goes without saying, I hope, that it will be well written, entertaining and/or relevant!) It is almost impossible for a very fluent reader, for whom, after all, almost all text is easy, subjectively to assess how demanding a text may be for a less fluent reader. We therefore need some sort of objective measure. For this reason, various "readability" tests have been devised. They can be useful, but must, of course, always be interpreted against more nebulous "measures" like interest, entertainment value, relevance, demand, etc. "Readability", in other words, is a rather dead, mechanistic yardstick to apply to a living thing like language. For example, all these readability assessment tests make much use of the average number of syllables in a word. The more there are, the harder the text. In general terms this is so, of course, but any long word will be much easier (because more interesting) for some people than for others. The words "underlying rate of inflation", for instance, immediately switch my mind completely off, whereas the words "assessment of literacy capability" do the reverse (and so mean much more and are actually easier to read).

I offer, here, three methods of assessing the severity of a text. They are all approximations, remember, and all express "readability" ultimately as a "reading age". The methods are the Flesch, the Fry, and the Smog. (Is this some kind of joke? I hear you shout!)

❒ **Smog readability Test**

This is perhaps the easiest test to apply. It goes like this:

1. Count 10 sentences.
2. Count the number of words of 3 or more syllables in those 10 sentences.
3. Multiply that total by 3.

4. Find the number in the list below which is nearest to your new total:

   4 9 16 25 36 49 64 81 100 121 169 196

5. Find the square root of that number.
6. That square root plus 8 is the readability of the text.

❒ **Flesch readability Test**

This is based on three ideas:

- The shorter a sentence the easier it is to read and understand.
- The fewer syllables there are in a word, the easier it is to read and understand.
- Sentences with more references to people (especially references to the reader!) are more interesting and so are easier to read and understand.

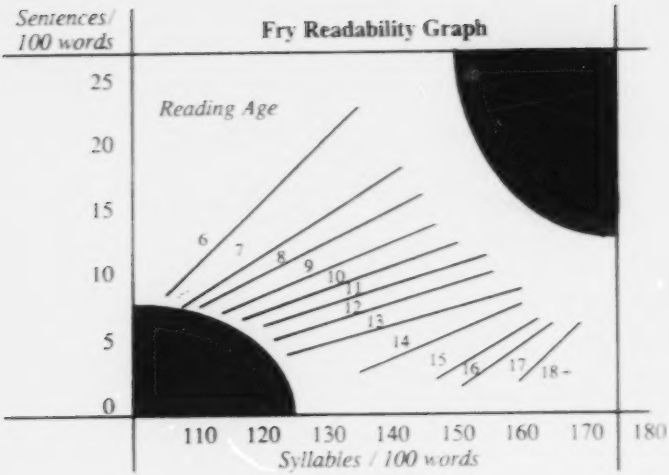
To carry out a Flesch assessment test you must:

1. Count 3 sentences and 3 blocks of 100 words.
2. Count up the number of syllables and the number of personal references in each block of 100 words. Find the average of these.
   Add them up and divide by 3.
   Count up the number of words in the 3 sentences. Find the average of these.
3. Add them up and divide by 3.
4. Look these figures up in the Flesch Readability table overleaf:

Flesch Readability							
Reading level	Very easy	Easy	Fairly easy	Standard text	Fairly hard	Hard	Very hard
Reading age	<11	12	13	14-16	17	18	Graduate
Syllables per 100 words	127	134	142	150	158	166	175+
Average length of sentences	8	11	14	17	21	25	29+
Personal references per 100 words	19	14	10	6	4	2	2-

❒ **Fry Readability Test**

1. Count a typical-looking block of 300 words
2. Count the number of complete sentences in the block
3. Count the number of syllables in the block
4. Divide both the above totals by 3 to find an average per 100 words, for each
5. Look up on the Fry Readability graph for approximate reading age


Sentences/
100 words
Fry Readability Graph
25
20
15
10
5
0
Reading Age
6
7
8
9
10
11
12
13
14
15
16
17
18+
110
120
130
140
150
160
170
180
Syllables / 100 words

Chapter Seven Notes

Listening skills: a method

Theory: We do not use the sounds of a word routinely when we write it, so long as we know the spelling in the first place. When, however, we meet a new spelling, an unfamiliar word, one of the strategies that we will inevitably use to produce candidate spellings for it is "writing down" the sounds it contains. To do this, we have to listen, and we have to listen in far greater detail, much more accurately, than we ever do in, say, conversation. The sounds of different letters, or letter patterns, can be astonishingly similar. (Stream is very nearly scream. What about ch, sh and ts? Was that bl or br; pat, pet, pit, pot or put?) The "mental ear" has to be trained to search for, and reliably identify, such apparently trivial minutiae. If it cannot, finding likely candidate spellings will be a skill a student finds difficult, almost incomprehensible.

The method goes like this:

i) Lists of words are made, about 30 words long. Each list will be of fairly simple words, each word containing only one of two or three alternative sounds the student will be asked to identify.

   For example, a list might be exercising the ear in telling the sounds *"st"* and *"sp"* apart and go like this: *"stop, start, spill, stocking, sport, speech..."* and so on.

   Another list might contrast *"n"* and *"m"* and go: *"missile, mop, nettle, never, needle, milk, nice, America, ants..."* and so on.

ii) The student is made aware of the need for this skill and how the method will be used.

iii) The student is told which sounds to listen for in the upcoming list. (They should be jotted down as an *aide-memoire* if this is felt helpful, e.g. *"cl or cr?"*)

iv) The list is read aloud to the student one word at a time. (The student should, of course, not be able to see the list!) All the student does is listen carefully and indicate after each word, verbally, which of the alternative patterns it contains.

(If the word had been "blue", for example, and the pattern alternatives bl or br, the student will simply say "Bee, ell".)

The student is not asked to do any more than this, particularly not to spell any word, and this must be made clear from the start. This is a pure listening exercise.

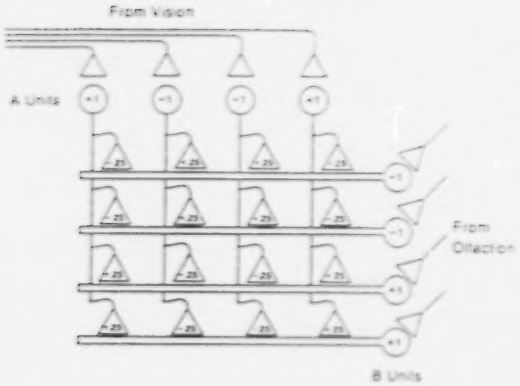
v) The student must not be placed under any pressure; a choice exercise publicly performed is stressful enough as it is! Sufficient time must be allowed for assimilation. Ensure that the student can "hear" any errors that are made before continuing.

As with all exercises, if the thing does not go well, stop it.

Pattern Associators

How might they enable us to learn and to respond?

In Chapter Seven I allude to pattern associators as a plausible paradigm for the management of learning and the subsequent association of learned items. Pattern associator networks, and networks of networks, provide an elegant model. As with all successful biological systems the model is economical in terms of both material and mechanism, in terms of both hardware and software as computer-speak would express it. The model has, in fact, been built into a computer and "behaves" in ways very characteristic of us humans. I present a very simplified paraphrase of a much more technical exposition found in Rumelhart and McClelland's two-volume "Parallel Distributed Processing" published in 1986.



A simple 4 × 4 pattern associator (Rumelhart & McClelland 1986)

You will remember that brain cells throw out numerous processes of varying length and that it is these cell processes which conduct stimulation — they are the actual wiring of the brain. Each cell, via its processes, can make and receive some two thousand connections with and from other cells. These connections can deliver or receive either positive or negative impulses which can be strong or weak. Connections can excite or inhibit strongly or weakly, they can be strong or weak on or off switches. Our simplified diagram envisages a small network of connections. It is a 4 × 4 net — in other words, 4 cell processes, from cells in one part of the brain, connect with 4 cell processes from cells in another part of the brain.

For the sake of argument we envisage here four "A" cells, from the visual cortex, connecting with four "B" cells from the olfactory (smell) cortex. To be specific, we envisage the "A" cells delivering input that a rose has been seen and the "B" cells that a rose has been smelled. The unit, in fact, "associates" the sight of a rose with its smell or, of course, vice versa. The sight of a rose will, via this network, elicit the smell of a rose and vice versa.

For the purposes of discussion we are assuming that the pattern from the visual cortex for "rose seen" is a "readout" of "Plus one, Minus one, Minus one, Plus one" (positive, negative, negative, positive with a strength of one in each case). The connections between the four "A" cell processes to the four "B" cell processes — sixteen

connections in all — are set as drawn, i.e. either positive or negative and with a strength of 0.25 in each case. The effect an impulse produces on the process on which it impinges is the product of the cell's level of excitation (or inhibition) and the strength at which the connection itself has been set. The total effect on the recipient, output cell is, of course, the sum of all connection stimuli as calculated above.

(Note that in order to understand the model you have to recall, from your "O" level Maths days, that "*a negative times a negative makes a positive*". This works in neuropsychology too; inhibiting an inhibitory connection has the effect of producing an excitatory connection. Hence the cocktail?)

For example, the uppermost "B" cell in our diagram receives four impulses. They work out at:

$(1 \times -0.25) + (-1 \times 0.25) + (-1 \times 0.25) + (1 \times -0.25)$
i.e. $-0.25 + -0.25 + -0.25 + -0.25$
i.e -1

Following the same procedure for all four sets of cross connections you can see that an input pattern, on "A" cells, of "+1, -1, -1, +1", when connection strengths are set as drawn, will produce an output pattern, on "B" cells, of "-1, -1, +1, +1".

The network will, of course, work in reverse. (It would also be perfectly possible to use the set-up as shown to associate more than two pairs of items! The same network could be used for a variety of associations. When you consider this, as well as the fact that cells make some five hundred times as many connections as we have here drawn, you can see that the possibilities for associative power are very considerable indeed.)

In effect, the "A" cell pattern is the mental representation of "rose seen" and the "B" cell pattern that of "rose smelled". The pattern of connection directions and strengths is, in effect, the learned association between them — the learned association between the sight and smell (or vice versa) of a rose. Learning is the establishment of those connections which will reproduce "A" pattern when "B" appears, and vice versa, the setting of the correct connections within pattern associators.

So much for the neuro-anatomical bit. How might it work in practice, this thing. How might learning actually happen and what

properties would behaviour mediated by pattern associator networks show?

In Chapter Seven I argue that we do not learn, and then apply, "rules". Using spelling in English I try to demonstrate that learning a plethora of abstruse, longwinded rules and a profusion of inherently unmemorable exceptions to them was almost certainly *not* the way we conquer the subject. I suggest, instead, that we learn patterns and patterns of patterns. Pattern associator networks show, with a rather convincing elegance, how this might actually occur.

We have to envisage an overall "programme" which instructs pattern associators to learn purely locally. That is to say that the value and direction of each connection within a pattern associator will be set according to a simple, inbuilt "programme" and solely by reference to the input to either side of it. The pattern associator, repeatedly given a particular this/that reality — a particular pattern on "A" and "B" cells in our example, representing the sight and the smell of a rose experienced at the same time — will "set" the connections automatically to the directions and values which make the best match between "A" and "B" patterns. Once the patterns have been presented a number of times the connections are "set" forever and then form a permanent memory of the association.

Using our example: presented with a good, strong visual image of a rose and a good, strong scent of a rose simultaneously there will be a good, strong pattern of excitations delivered as drawn to both sides of our pattern associator. The pattern of connections will tend to that shown, which best maps "A" onto "B". Doing this a number of times will "set" the connections to the values and directions shown. Present the smell of a rose, thereafter, and you recall "rose seen" and vice versa.

A likely early candidate paradigm for how a pattern associator might be "pre-programmed" to programme itself thus, on demand, was the "Hebb rule" — perhaps the only rule your head actually contains!

> *When units A and B are simultaneously activated, increase the strength of the connection between them. Adjust the strength of the connection between units A and B in proportion to the product of their simultaneous activation."*
> (Rumelhart and McClelland (1986), p. 36)

I commend the voluptuous simplicity of this paradigm. Our little network learned the association of patterns A and B but used nothing more than a relatively simple, switch-setting programme and the two patterns themselves applied to either side of the network. The associator did not refer to any other part of the brain, to any learned principle or set of rules from without. The association was learned locally, right down at the level of the switches in the wiring itself. The same "Hebb rule" — or something like it — might govern all such learning, wherever in the brain it takes place. What is learned depends, of course, on what, if anything, is input to the two sides of the network!

How does the model behave? The model has been built into a computer and given various things to learn, among them the present and past tenses of regular and irregular verbs. After a number had been learned, new "non-word" forms were presented (e.g. purd, gimp). The machine postulated regular past tense endings (e.g. purded, gimped). The machine also "over-regularised" some already learned irregular forms (e.g. wented, camed) exactly as children do. The machine apparently behaved in a rule-mediated way, though it did not "know" the rule at all.

> *"The model learns to behave in accordance with the rule, not by explicitly noting that most words take ed in the past tense in English and storing this rule away explicitly, but simply by building up a set of connections in a pattern associator through a long series of simple learning experiences. The same mechanisms of parallel distributed processing and connection modification... serve, in this case, to produce implicit knowledge tantamount to a linguistic rule. The model also provides a fairly detailed account of a number of the specific aspects of the error patterns children made in learning the rule. In this sense it provides a richer and more detailed description of the acquisition process than any that falls out naturally from the assumption that the child is building up a repertoire of explicit but inaccessible rules."*
> (Rumelhart and McClelland (1986), p.40)

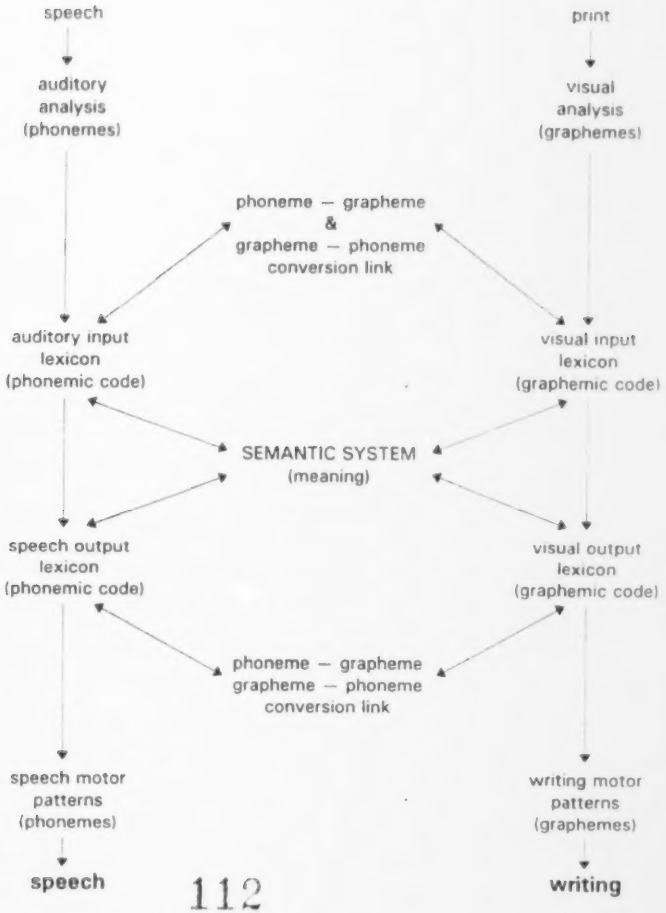
There is one other major interesting property of the human mind which the pattern associator can gracefully explain. In Chapter One the "feature analysis" recognition system was discussed. I put forward

the idea that the thing was imprecise and would accept input that was "woolly". I said that it was much more useful that way, because reality presents in such various and constantly changing forms that we need to be able to decode information even when it is not exactly as previously, or even as ever before, presented. I used the dog as example, but, of course, without the ability to decode imprecise information we would never be able to read each other's handwriting.

In our diagram we postulated that the input pattern, on "A" cells, for "rose seen" was plus one, minus one, minus one, plus one. This was the perfect pattern for a clear sight of a standard rose in good light and so on. It delivered output, on "B" cells, of minus one, minus one, plus one, plus one — the scent of a perfect rose in full bloom. Suppose our rose was a bit hangdog, though, a bit bashed about, not many petals remaining? We can envisage that the input pattern, on "A" cells, would degrade to, say, plus 0.5, minus one, minus 0.5, plus one. Applied across the connections as set this would produce an output, on "B" cells, of minus 0.75, minus 0.75, plus 0.75, plus 0.75. These are still pretty close to "perfect" values and are all in the correct direction. The output signal would still, we may conclude, be good enough to trigger "rose smelled" in the olfactory centres. In other words, with incomplete, degraded input we still managed a perfectly adequate association, as we do in reality all the time.

Appendix 1

Language Management: Probable Pathways



This diagram shows the probable pathways whereby language is managed in the left brain. An important proviso to keep in mind when studying the diagram is "spreading activation". Remember that for almost everyone on Earth the spoken pathways are much the most often used. We speak far more than we read or write. These pathways are very easily activated, therefore — very well oiled! When we spell straight from meaning, for example, we do the following:

- we activate the word-as-meaning in our central semantic lexicon
- we activate the word-as-grapheme in our visual lexicon
- we use this to activate the word-as-motor-instructions
- we execute these instructions; we write down the word-as-symbols.

BUT, it can *feel as if* we are writing via sounds, because we often hear the word-as-sounds as we write. This is nothing to do with spelling; it is *secondary spreading activation.* Activating a word-as-meaning in the semantic store tends strongly to activate word-as-sound *regardless of what else is intended.* When I write, I believe I usually "hear" the word in my head. Suppose I write a couple of long words ("spreading activation", for example) I hear the words, *but not at exactly the same time as I write them.* In fact, I hear "spreading" while I write the first couple of letters and I hear "activation" while I write the last few. The exact timing may be different for you. I bet you don't "hear" familiar, easily spelled, words sounded out "in synch" with your writing, though. In other words, *your hearing the word is not related to your spelling the word, it is just the secondary activation of a very commonly-used pathway.*

A fascinating thought arising from looking at this diagram is that we can probably repeat speech, and reproduce writing, without going anywhere near its meaning! Sometimes I believe I do this. We might even, by using the phoneme to grapheme conversion link, be able to fulfil that old definition of a lecture: "a method of getting the lecturer's notes onto the student's paper without passing through the minds of either of them"!

Appendix 2

Ken's story

The teacher in my first school was only interested in those who were bright. Because I was slow to begin with, I was left to carry on alone while he continued with the rest of the class. There were seven or eight of us unable to read and write, but no one offered any extra help. Even though my parents were aware of the problem they did nothing to help. I realise now that they should have spoken to someone at school. When I was eleven years and it was time to sit the Eleven Plus, I was unable to cope with any part of the exam.

Starting my secondary education looked hopeful. All the children with a problem like mine were grouped together in one class. Present day standards would mean that a teacher with a class like this would be qualified to educate children with special needs; mine wasn't.

Throughout my last years in school I excelled in the craft subjects, and discovered that I was good at practical work. Subjects that involved reading or writing I was repeatedly punished in, because I was unable to cope. I can remember on occasion, during a Welsh language lesson, being made to stand outside the classroom door. When I was discovered there by the headmaster, he would take me to his room and cane me.

Looking back, from an adult point of view, I think I was too young to see the problem, let alone ask for help. Also, I don't think I could see the importance of it; I mean, if they couldn't teach me English, what hope did they have of teaching me Welsh?

After leaving school, obviously with no qualifications, I took a job as an apprentice painter; from there I went to work for another firm, painting again — in both cases, jobs which required no knowledge of reading and writing.

Being unable to read or write has made me feel incomplete. I have never been able to conduct any business matters, for fear of having a form to complete. Even a simple matter of filling in a cheque was impossible. Everything of this nature Ann, my wife, has had to do, which understandably has, at times, caused a lot of stress. This was particularly the case when we were in the process of building houses and dealing with professional bodies.

After telling Ann, she tried several times to help but we usually ended up rowing. She even told her sister-in-law, who is a junior school teacher. Although she offered to help I was too annoyed and embarrassed. With no local adult education classes at that time the subject was just avoided because I used to get so uptight about it. More difficult and embarrassing moments came when my son started to read at school. On occasions, he would ask me to read something and Ann would always have to take over. What makes it worse is that he is very bright.

Ann never gave up. I think I acted like an ostrich for most of the time. Whenever she thought the time was right (when I wouldn't jump down her throat), she would bring the subject up again. Unlike me Ann searched local newspapers and listened to any TV advertisements on adult education. We discovered that adult education was available by telephoning our local council, which Ann did. When Ann discovered that adult literacy classes were being held in our town she couldn't believe her luck. I was horrified to think that classes were now within easy reach and I made all kinds of excuses not to go. I think the biggest worry I had, apart from being so embarrassed, was meeting someone I knew.

With my excuses almost exhausted the only argument I had left was my shift work. This did not deter Ann; she wasn't going to pass up an opportunity like this so she telephoned the school for details. A date was set for us to meet the lady who was in charge of the literacy classes. I was sick with nerves and really bad tempered. When we arrived at the school and started to talk to her I found I was able to tell her exactly what I needed. What helped me to speak so freely was realising that she and the other tutors were there just to help people like myself. Everyone was so helpful, they even tried to arrange classes around my shift work. We left, after receiving a timetable.

I was convinced that I was a hopeless case. The day of my first visit arrived, after a very tetchy time between Ann and myself. I left home for the school feeling absolutely terrified, the reason being mainly the fear of coming across someone who knew me.

My tutor's name was Daphne. She was terrific. I was made to feel comfortable and it was easy to talk to her. It was surprising to discover so many people, of all ages, having problems similar to my own. After keeping my dark secret it was difficult to cope, bringing it into the open. By this, I mean discussing it with strangers, from whom

I had spent a lifetime keeping it hidden. Even though I still felt it an impossible task I was pleased with myself for having taken the first, to me enormous, step.

Appendix 3

The Breakdown — A Maze
By Joyce

Read the first paragraph. You will find, then, that you have a choice as to what to do next. Make your choice and turn to the paragraph of that number. Follow this method after reading each paragraph. With any luck you may get through the maze!

①

When you left home this morning to go to work, you noticed that the car didn't sound right. Now, coming back from work, it is worse. You are halfway up the big hill, four miles from home, when it stops altogether. It is November and it is cold, dark, and raining. You are in a hurry to get home tonight because it is your wedding anniversary and you are going out to eat. Your table in an expensive restaurant is already booked.

What do you do now?

④ You get the torch out of the glove box and try to find the fault.
⑨ You get the torch out of the glove box and go looking for a phone.
③ You wait in the car for the rain to stop.

②

You walk the half a mile to the phone box. Halfway there the torch goes out on you. There is no street light but you carry on. You can see a light in the distance and hope it is the phone box. You feel relief at seeing the phone box, but when you get there you find it has been vandalised.

Now you decide to:

⑦ Take it out on the phone box.
③ Go back to the car.

③

You have decided to wait in the car for someone to stop or at least until the rain stops.

This gets boring, so you:

④ Have another go at finding the fault.
⑨ Get the torch out of the glove box and go looking for a phone.

④

You start to look for the fault. First you lift up the bonnet, looking for loose wires. You can't see any. You take one more look, this time at the water, oil and fan belt. You still can't see anything wrong.

What now?

Go back to ①

⑤

Hoping that the fault has remedied itself, you go to find the fault for one last time. No luck at all. The car is on its last legs; time it went to the scrap-yard. It's really raining cats and dogs now, so you:

⑧ Walk home.
⑨ Get the torch out of the glove box and go looking for phone.

⑥

At last a car stops and gives you a lift home, but you are now two-and-a-half hours late. The wife won't speak to you. The restaurant has let your table go and she thinks you are late on purpose.

Go to ⑧

⑦

You've taken it out on the phone box, but you still don't feel any better and it has started to rain again.

You decide to:

③ Go back to the car and wait for the rain to stop.
⑤ Have another go at finding the fault.
⑥ Stand out in the rain and try to thumb a lift.

⑧

You put the key in the lock and shout that you are home. There's no reply, yet you know the wife is home as the telly is on full volume. You tell her that you weren't late on purpose, but you're glad you're late. Now you won't have to share her with a room full of people. Why not open a bottle of wine and some crackers to celebrate instead? She agrees to this with a small smile on her face as she goes for the wine.

☺ You are out of the maze — enjoy the crackers!

⑨

There's a farm up the road. You go there to see if they have a phone. A man comes to the door and you ask him if they have a phone. He says they do, but there's a phone box down the road. He shuts the door before you can ask to use theirs.

What do you do now?

② Walk half a mile the other way to the phone box.
③ Go back to the car.

Appendix 4

Language Experience and Visuo-Motor Learning
(spelling: an example, with a non-beginner)

Aim: To trawl student's own writing for important errors, patterns of error, anything else relevant; to teach to these.

Method: get writing from student: collect errors important either:
as *common words*
or as *frequent patterns*
or as *particularly relevant*

learn by Look-Cover-Write-Check and Simultaneous Oral Spelling. (LCWC & SOS. See Chapter Seven)

review, revise, use.

For example:

Student misspells		
	fesant	[pheasant]
	haf	[have]
	marckit	[market]
	arctoner	[auctioneer]
	toilit	[toilet]

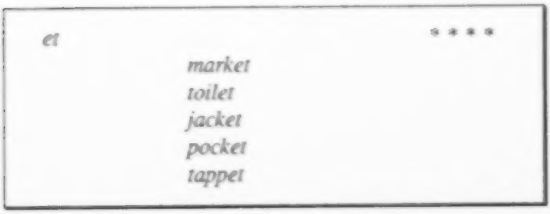
Suggestions:

1. Ignore *fesant* unless very relevant.
2. Teach *have* with, say, *give, love, drive.*
3. Teach *market* and *toilet* with, say, *jacket, pocket, tappet* (if relevant).
4. Teach *market* with, say, *dark, park, work, talk, walk.*
5. Ignore *arctoner* unless very relevant indeed.

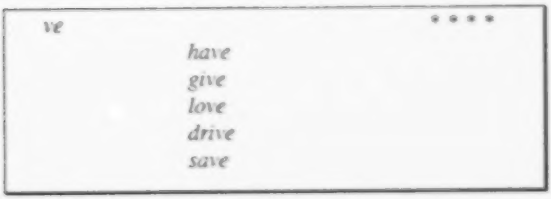
Don't "explain" spellings (for example -k/-ck endings) even if asked to do so! ("Ar rools enny uce?" and see Chapter Seven)

Learning technique:
Make spelling cards showing: *pattern to be learned*
list of words using pattern
rating of pattern frequency

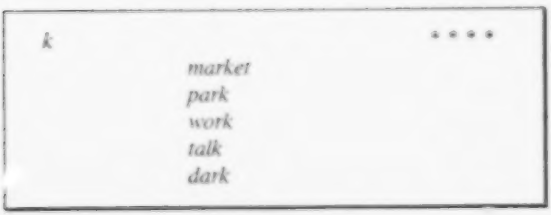
e.g.



and



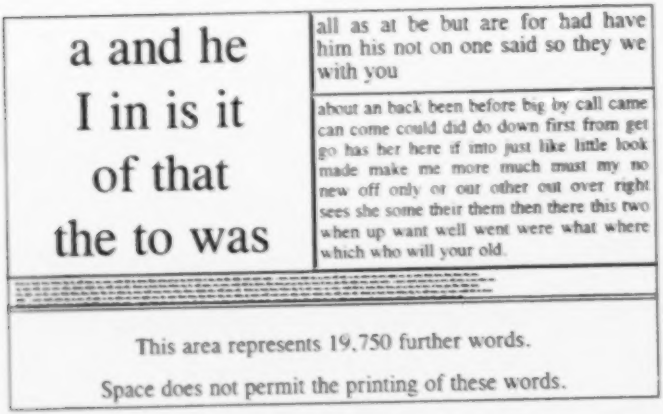
and



These cards to be learned, at the student's pace, in class and/or at home using *only* LCWC/SOS method!

Appendix 5

The Ubiquity of the "Keywords"


a and he
I in is it
of that
the to was
all as at be but are for had have him his not on one said so they we with you
about an back been before big by call came can come could did do down first from get go has her here if into just like little look made make me more much must my no new off only or our other out over right sees she some their them then there this two when up want well went were what where which who will your old.
This area represents 19,750 further words.
Space does not permit the printing of these words.

A proportional representation of the most used words in English as applied to the vocabulary of an average adult. From Beard (1987), p.77

and:

If you have ever been on an *underground train* in *London* you will have *seen* the *pipes* that *hang* from the *walls* of the *tunnels*. *I believe* that one of these *pipes* is a *curry pipe*. *I think* that there is an *enormous boiler* in the *middle* of *London* which makes *curry twenty-four hours* a *day* and that this *curry* is then *pumped* out, along the *curry pipe* in the *underground*, to *restaurants* all over *town*. This is the only *explanation I* can *offer* for the fact *that curry looks* and *tastes exactly* the *same* all over *London* but is *hotter* in the *centre* of *town* than in *the suburbs*.

Glossary of Terms

Andragogy — The study and practice of the teaching, specifically, of adults (as opposed, for example, to pedagogy, the teaching of children).

Association — The translating of brain activity from one subject, or aspect of a subject, to another; the elaboration and intertwining of thought processes through spreading activation. Almost all (about ninety-five percent) of activity in the brain is this spreading association of "thoughts" rather than the simple receipt and acknowledgement of inputs. It is probably achieved through pattern associator networks.

Bottom-up processing — The opposite of top-down processing, bottom-up processing is the making of mental decisions based only on the unselective collection and analysis of information. The mind is held to be utterly open, empty even, and no hypotheses or ideas influence the eventual decision. "Raw" data is collected, en masse, and looked at within the mind until enough is available to decide what it all means.

Broca's area — Named after a nineteenth-century researcher into cognitive psychology, this area, usually found in the left brain, is responsible for translating the mental representations of language as meaning, emanating from the language association centre, into such patterns of motor impulses which will cause the appropriate sounds to be made; will reproduce the language as speech.

Cascading analysis — The analysis of data, of information, in the mind by a combination of top-down and bottom-up processing. By combining the analysis of raw data with the search for confirmation of a likely hypothesis a good decision can be made rapidly and on the basis of only a small amount of information.

Cognitive psychology — The study of cognition, of how the mind actually does all those things it normally does: this would include, for example, the study of perception, memory, the solving of problems, control of movement and position, language storage and production, reading, writing, and so on and so on. The subject is nothing at all to do with Psychiatry.

Dysgraphia — difficulty with writing, of neurological origin. The term dyslexia is often loosely used to mean either, or both, dyslexia or dysgraphia.

Dyslexia — difficulty with reading, of neurological origin. It can be acquired, in which case the brain is damaged after reading has been learned (e.g. after a stroke) or developmental, in which case there is held to have been something wrong with the brain from very early in life. It is developmental dyslexia which remains controversial.

Feature analysis — The recognition of things (cars, words, people, etc.) by search for, and analysis of, only a small number of features. Probably managed by cascading analysis.

Fixation — The period, especially during reading, when the eyes are held still.

Grapheme — The smallest visual representation of language. All letters are graphemes, but so are signs like 1, 2, 3, £, $, ?, &, +, -, =, and so on.

Graphemic code — The mental representations of graphemes; the code in which the mind stores the visual representations of language.

Language association area — The semantic system. This area, usually in the left brain, seems to be where meaning as language (or do I mean language as meaning?) is represented and stored, in semantic code. All language transactions, visual or auditory, apparently involve this area.

Language experience — The teaching method in which the main source of material for study is work produced by the student(s).

Morpheme — The smallest meaningful unit of a language. ("mean", "ing" and "ful" all carry meaning, so are morphemes. "Cat" is a morpheme, but so is "catastrophe", as are "fish", "er" and "man".)

Motor — In the neurological sense motor is the opposite of sensory. A motor impulse, carried down a motor nerve, is one which will stimulate an action, usually the action of a muscle. Motor nerves deliver instructions away from the brain.

Neurological — To do with the central nervous system and its arrangement, in a word, the "wiring" of the brain.

Pattern associator — A network, possibly very small, of connections between brain cells which enables one pattern of impulses (one "thought") to be translated into another, (association). A smell may, for example, evoke a memory. Pattern associators work tolerably well even if information is incomplete or degraded and the same associator may work for more than one input/output pattern pairing.

Phoneme — The smallest sound unit of a language recognisable by ear. (h, a and t in "hat", for example, but th, a and tch in "thatch", f, ar and m in "farm".)

Phonemic code — The mental representations of the sounds of language. The code in which the mind stores phonemes.

Phonics — The teaching method in which reading and spelling are taught solely as the representation, in text or writing, of sounds. ("kuh" "a" "tuh" "cat", but, by the same token, "fuh" "O" "nuh" "i" "ks", (phonics?), "huh" "oh" "muh" (home?) and "kuh" "ugh" "muh" (come?))

Priming — An experimental technique especially useful for investigating how the mind manages language. Subjects are "primed" with one stimulus and then given a "target" stimulus about which a decision is required. Varying the prime stimulus may affect performance of the decision on the target stimulus, and insights may be thereby gained into what was going on in the subject's mind.

Saccade — The rapid movement of the eyes, especially during reading, between *fixations*.

Semantic — To do with meaning.

Semantic code — The mental representations of the meanings of language. The code in which linguistic meaning is stored in the *language association area*.

Semantic system — See *Language association area*.

Sensory — The opposite of *motor*. Sensory nerves carry information to the brain from sense organs.

Spreading activation — The spread of mental activity laterally within the mind, from one area into another. A thought on one subject spilling into others. (Hearing a bird sing may make you think of summertime, and your upcoming, perhaps yet-to-be-planned, holiday, your yet-to-be-bought wardrobe, your yet-to-be-awarded payrise and your yet-to-be-approached boss.) (See also *association*)

Syntax — The structure of language, how words are placed in relation to one another.

Top-down processing — The process whereby the mind analyses incoming information in the light of an idea, a hypothesis, it has already formed as to the probable meaning of the information. It is the opposite of bottom-up processing and enables reliable decisions (on the whole) to be made very quickly and with a minimum of information, even incomplete or degraded information.

Visual span — The amount the eyes see acutely at a single fixation. (About a five-degree span, in fact, giving a fairly acute view of several words at a time.)

Visual cortex — Right at the back of the brain, this area "sees". Part of the area is specific to the decoding of written language (into graphemic code). It is the anatomical site of the "visual input lexicon"

Wernicke's area — Named after a nineteenth-century researcher into cognitive psychology, this area, usually in the left brain, is responsible specifically for decoding speech (into phonemic code.) It is the anatomical site of the "auditory input lexicon"

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